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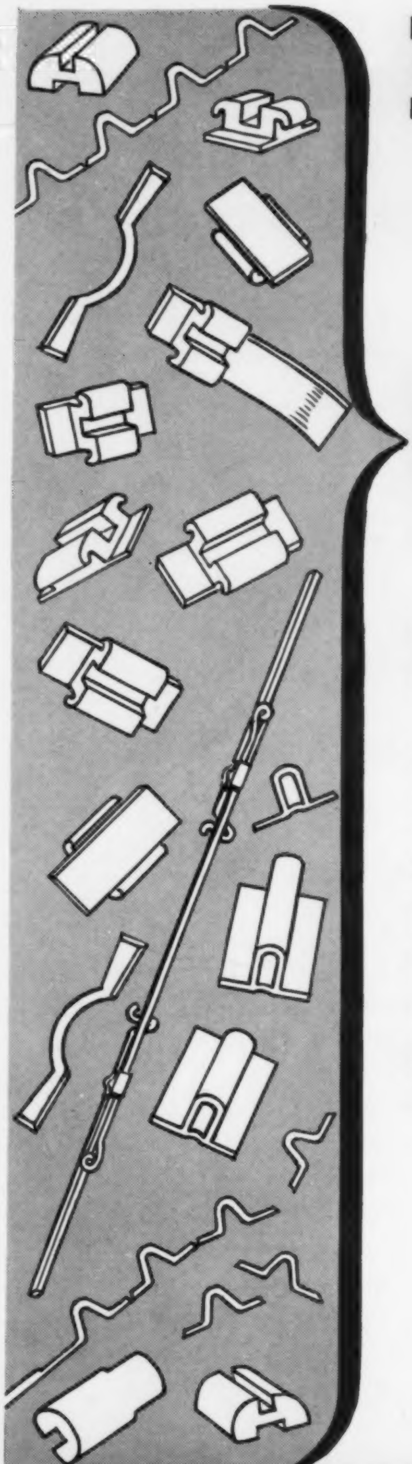

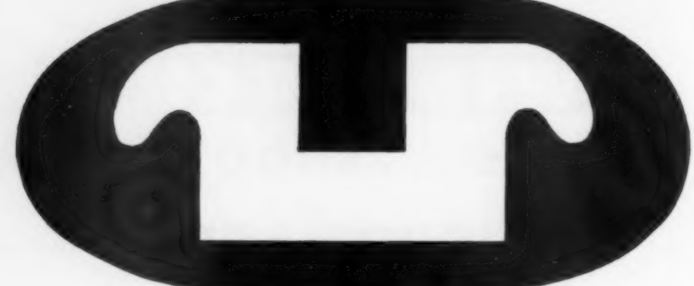

American Journal of ORTHODONTICS

VOL. 38 OCTOBER, 1952 No. 10

Original Articles

PROCEDURES FOR CASE EVALUATION AND ANALYSIS*

EDWARD RAY STRAYER†

DEFINITION

WEBSTER defines evaluate and analysis as follows:

Evaluate: To fix the value of, to rate, to appraise.

Analysis: To unloose, to dissolve, to resolve into its elements. A resolution of anything whether an object of the senses or of the intellect into its constituent or original elements; an examination of the component parts of a subject. . . .[1]

Applying these definitions to orthodontic problems brings us into the realm of decision by way of two stages.

First, evaluation should be considered the initial step in the orthodontic program. To evaluate a case is to determine whether it is in need of treatment and whether it has treatment value. If not in need of immediate treatment, should it be considered as needing attention at some subsequent time and should it be placed under observation?

Frequently we are consulted by parents who are concerned because they see various phases of oral development which to them appear grotesque and alarming. Such sights as the ugly duckling stage,[2] the delayed eruption, prolonged retention, and early loss of teeth, thumb-sucking, mouth breathing, and other functional abnormalities are common examples of conditions which arouse early concern for the child's welfare. These conditions can be appraised quickly by the experienced orthodontist and the proper assurance and recommendations given to the parents.

If the case is rated as an orthodontic problem needing attention, the appraisal must include a decision providing for the immediate disposition of the case. Thus evaluation is concerned with the initial consideration of a case and is the medium through which it is determined whether or not it shall be carried to the second stage of attention.

*This paper was prepared in partial fulfillment of the requirements for certification of Dr. Strayer by the American Board of Orthodontics. It was unanimously recommended by the Board for presentation before the American Association of Orthodontists in St. Louis, April, 1952. The untimely death of Dr. Strayer on Dec. 16, 1951, made it impossible for him to present this paper personally. It was read by his confrere and friend of long standing, Dr. Will M. Thompson, of Pittsburgh, Pa.—*Ed.*

†Deceased.

Second, analysis, the second stage of decision, is the process by which we mentally disassemble our problem and thus determine the cause, growth, and developmental inadequacies, anomalies, size of the teeth and jaws, teeth and supporting structural relationship, mandibular posture, interrelationship of the teeth, other associated conditions, treatment requirements, and the means by which we shall reconstruct the assemblage into a satisfactory functioning part of the living patient.

It seems hardly necessary to stress the importance of evaluation and analysis because, to attempt the correction of malocclusion without first carefully appraising and then examining the component parts of the problem, the operator will not have a thorough understanding of the fundamental difficulties and needs of the case. Thus he will be starting treatment prematurely or be poorly prepared to care for the patient in the most orderly and satisfactory manner. If his objective is to reach the end of treatment without aimlessly wandering about, then, before starting, he must given careful attention to analysis and planning his procedures. Following this he must then work his plan.

There are those whose concept of analysis does not include more than designing an appliance to move the teeth. While this is an associated part of analysis, it is not the only consideration or the place to begin. The present concept of case evaluation and analysis reaches far beyond that of earlier years when little was known of growth and development of the cranium, face, jaws, and their associated parts. One of the most common ideas prevalent in that early orthodontic thinking was that when the treatment had produced a contact point alignment of the teeth in their respective arches and when the inclined planes of these teeth were properly interdigitating with those of the opposite jaw, then nature would grow a sufficient quantity of supporting bone under this man-made arrangement because function was calling for its delivery to complete and stabilize the case. The idea that placing the teeth right would make all the associated structures "kowtow" to these newly enthroned dictators many times met with defeat. The collapse of such cases and other attempts to violate nature's potentials and capacity have been extremely disappointing but fortunately for the progress of the specialty, thought-provoking and enlightening. These failures have caused us to try to understand nature's intent and capacity and from this understanding plan our treatment so it will complement the inherent qualities of the individual and not try to force impossible changes upon him.

A review of various older textbooks of orthodontics reveals that the positions of the teeth and classification of malocclusion are the principal considerations when treatment of a case is contemplated. In conjunction with this some attention is given to the facial outline associated with the malocclusion. Dr. Calvin Case makes this point about facial outline, "By carefully scanning the author's present classification, it will be seen that while distinct characters of mal-occlusion are now divided among the three classes upon the basis of their disto-mesial occlusion, their true basis of diagnosis and treatment is dependent very largely upon facial outlines in relation to the standard of esthetic perfec-

tion for the individual, because it is not otherwise possible as a guide to treatment to determine whether the dentures—one or both are really protruded or retruded."[3]

Dr. Edward H. Angle devotes an entire chapter to facial art and places his main emphasis on the proposition "that the best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there shall be the full complement of teeth, and that each tooth shall be made to occupy its normal position-normal occlusion."[4]

Basically most authors follow the plan of classification as first presented by Dr. Angle and then endeavor to include an extensive variety of tooth relationships. In some respects this is more confusing than enlightening. Dr. Angle in his seventh edition refers to the "seven distinct positions which teeth in mal-occlusion may occupy, indicated by their deviation from the line of occlusion." Also he indicates that there are innumerable malocclusion combinations and arrangements, but that all of these can be catalogued in three easily recognized groups or classes. The fundamental basis for these classes is that they are "based on the mesial distal relations of the teeth, dental arches and jaws which depend primarily upon the positions mesio-distally assumed by the first permanent molars on their erupting and locking. Hence in diagnosing cases of mal-occlusion we must consider, first, the mesio-distal relations of the jaws and dental arches, as indicated by the relation of the lower first molars with the upper first molars—the keys to occlusion; and second, the positions of the individual teeth carefully noting their relations to the line of occlusion."[5]

This question of the relative infallibility of the first molars as guides in case classification has been questioned in the past by very able orthodontic thinkers. Yet this basis for classification has prevailed and most cases are measured by these criteria. It would appear that Dr. Angle's individual use of this method was broader than his written word indicates. This supposition is based on his reference to the "mesio-distal relations of the jaws and dental arches." If he had not continued, "as indicated by the relation of the lower first molars with the upper first molars," there would be little doubt that size and position of the lower jaw were considered a major factor by him in his case analysis.

The most practical and comprehensive plan of classification has been given by Dr. Robert H. W. Strang for the first time in his first edition of *A Text Book of Orthodontia* and revised in the second and third editions.[6] He makes it clear that the lower dental arch and body of the mandible in relation to skull anatomy are the important factor in classification. In addition to this he tabulates six steps to be followed in deciding the classification of a case. The most outstanding of these is his step six which deals with midline relationship. This has tremendous value in treatment planning because it aids the operator in determining if the median line deviation is due to the malalignment of the dental units within the arches or is caused by a condylar shifting or displacement of the mandible. In the third edition Dr. Strang adds a seventh step in his classification procedure, "A Study of Profile Radiograms." Since the advent of the x-ray many previously unrecognized and unconsidered conditions of the head,

face, teeth and jaws, and also the associated soft tissues have been revealed. Of particular value are cephalometric x-rays, for with the use of these we are not restricted to a limited view of the condition we have to treat, and we are assisted in obtaining a better understanding of our problems. Therefore, classification of malocclusion from the standpoint of the teeth alone is no longer the item of first consideration and the essence of pretreatment procedure but only part of case analysis.

The assemblage of data for case analysis should include the following:

1. A complete history of the patient.

2. A dental history of the parents and grandparents, including an observation of the parents, if possible.

3. Exact models of the mouth with tissue details labially, bucally, and lingually to the fullest extent possible.

4. Complete intraoral x-rays, including bite-wing films.

5. Oriented headplate x-rays.

6. Oriented photographs.

Much of this procedure is routine in most offices. However, the importance of items one and two is ignored entirely many times or given slight consideration. Diseases, habits, and eruption of the teeth are reviewed with considerable concern when studying the history but seldom does the operator pay much attention to the height, weight, and general structure of the patient. This latter phase should not be ignored because, if properly evaluated, it is a key to the future development of the patient.

From clinical observation it appears that patients who present a well-developed skeletal structure and better-than-average height are more likely to develop adequate supporting structure for their teeth than those patients who present less-than-average height and poor skeletal development. In those cases where this has been observed the principal favorable change seems to be in the area posterior to the permanent first molars. The association of the foregoing consideration with item two of our analysis data is exceedingly important because the parents, when carefully observed, reveal the future developmental possibilities of our patient. While it is recognized that children do not inherit unit characteristics, nevertheless facial pattern, tooth size and arrangement, and general skeletal development often favor the characteristics of one of the parents. While it is not possible to set forth an exact formula for comparing the parent-patient factors, yet it is important to make the evaluation. The extent to which this will be valuable depends on the analyst's power of observation and experience.

It is not uncommon to find that parents of patients have had orthodontic treatment and the type of deformity in some cases is described as almost identical or much like the condition presented by the child under study. By observation, examination, and questioning the parent, one can learn the type of treatment he received, the problems encountered, and the measure of success resulting from the treatment. This may serve as an excellent guide in the treatment

of the child, because here is a sample of the possible fulfillment of the treatment procedures and the inherent potentials of growth and development. When removal of teeth is under consideration, this comparison is exceedingly valuable.

While inquiring about the dental history of the patient's grandparents, to some, may seem unnecessary or of no value, nevertheless, there is the possibility of obtaining some clue from this information which will aid in a better understanding of the case at hand, especially when Class III malocclusion is under consideration.

Having assembled the case analysis data and appraised the salient parts of items one and two as described in the foregoing discussion, we now pass on to the study of the oriented headplate x-rays. From these we expect to determine the values of the basic structures that must support the dental units which we plan to move into locations of more favorable relationship, function, and stability. If orthodontic problems were confined only to the teeth and jaws there would be fewer insurmountable difficulties. However, such is not the case; therefore, we must examine all the associated parts of the cranial and facial complex in order to discover wherein inadequacies exist to disturb the optimum balance and harmony. Because the mandible is the only moving element in the head, except the slight movement of the ossicles of the ear, it seems best to assess it first. This can be accomplished by studying it for type, pattern of development, symmetry, and balance, also noting if it presents any marked inadequacies or anomalies. Following this the component parts should be appraised in an orderly manner to determine what each part contributes to the mandible as a whole. The following sequence is a satisfactory method of approach:

1. Body length, measured from gnathion and the anterior alveolar border to the mandibular notch and internal angle.
2. Body height, measured from the lower border of the mandible to the alveolar crest; also to the incisal and occlusal edges of the teeth; these measurements to be made in the molar, premolar, and incisor areas.
3. Ramus and condylar height, measured from gonion to the head of the condyle; also ramus width from the anterior to the posterior border.
4. The type mandibular angle at gonion—acute, obtuse, or right angle.
5. Relation of the dental units and their alveolar support to the body of the mandible. In the incisor area this should be noted in reference to gnathion; also the axial inclination of the incisors.
6. The posture of the mandible.

From time to time some different approach to headplate study is emphasized and it might appear that it is the big answer to our case analysis problems. However, after thoughtful consideration it will be noted that there is not any one plane, angle, or measurement that can be relied upon as an infallible guide in reaching a decision. The entire complex must be considered and evaluated on the basis of the contribution each part makes toward the whole. There are conditions where a deficiency in one part is compensated for by modification in another. Sometimes the over-all length of the mandible will com-

pensate for an unfavorable Frankfort-mandibular angle. In cases in which the mandible has well-balanced component parts and as a whole unit is adequate to accommodate the dental units in stable positions, but in relation to cranial anatomy presents a distal malocclusion, it can be observed that the posterior

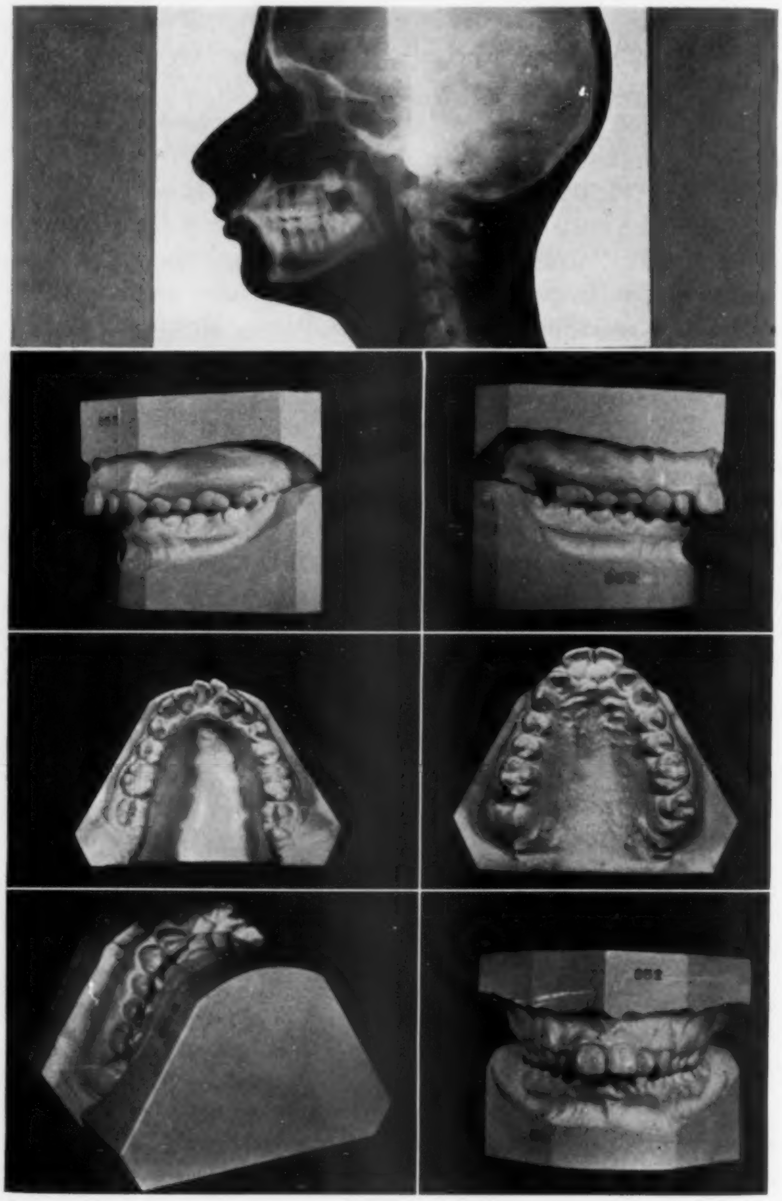

Fig. 1.—Headplate x-ray and models of a Type A, subdivision I case.

border of the ramus exhibits a close proximity to the vertebral column. This relationship seems to be indicative of the lack of adequate forward growth and development in the glenoid fossa area of the temporal bone and the other associated structures anterior and posterior to it. Mandibles that are so distally positioned belong to one of the several types of Class II malocclusions. Of the

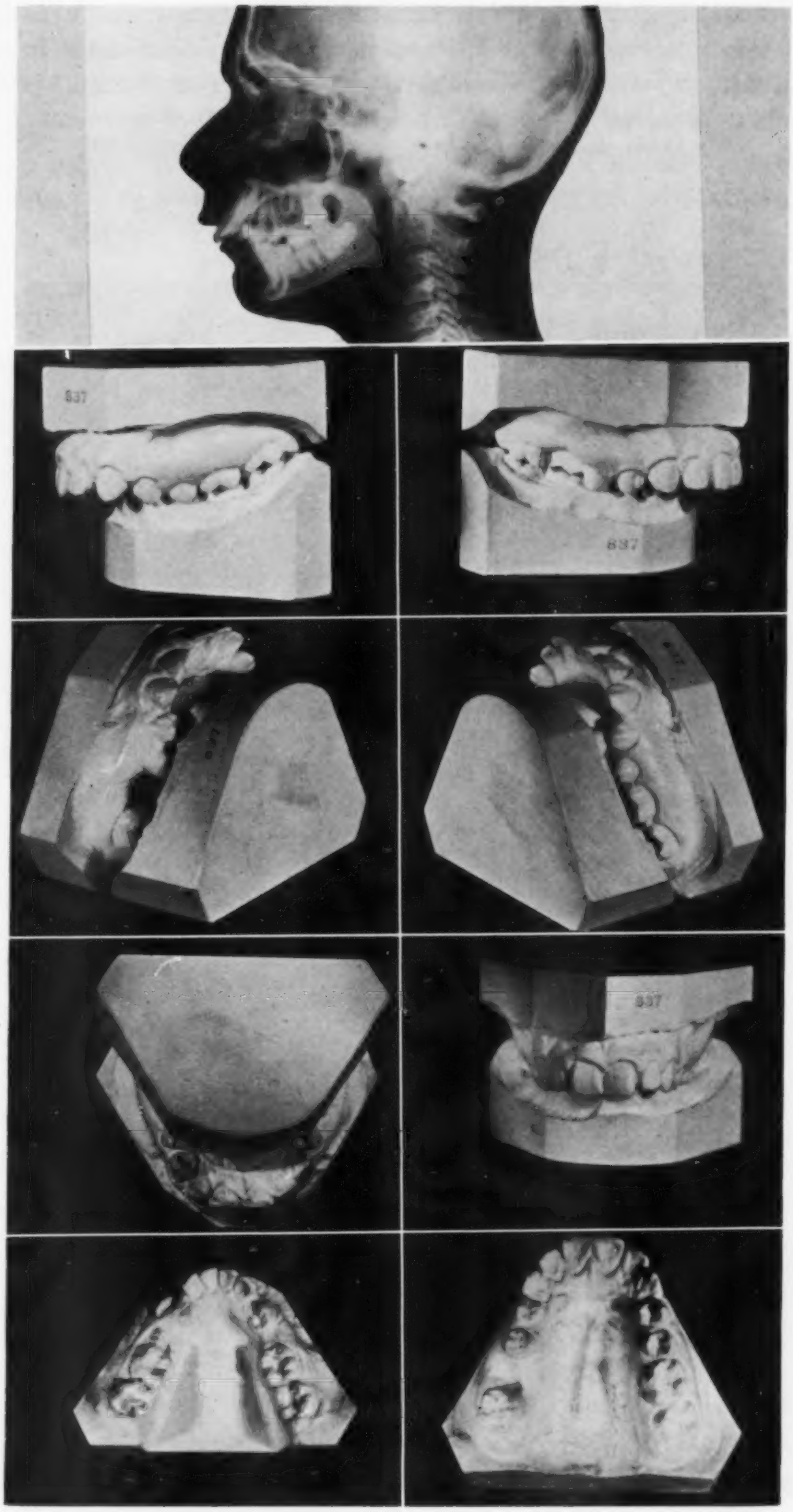

Fig. 2.—Headplate x-ray and models of a Type A, subdivision II case. Note the close proximity of the posterior border of the ramus in relation to the vertebral column.

three great classes of malocclusion, Class II presents the most variable cases. This variation is the result of growth and development disharmonies in the total accomplishment of the cranial and facial complex. The several combinations which seem to occur as discernible types may be described as follows:

Type A.—Cases in which the mandible is distally positioned in relation to cranial anatomy with the posterior border of the ramus in close proximity to the vertebral column. This type may be subdivided:

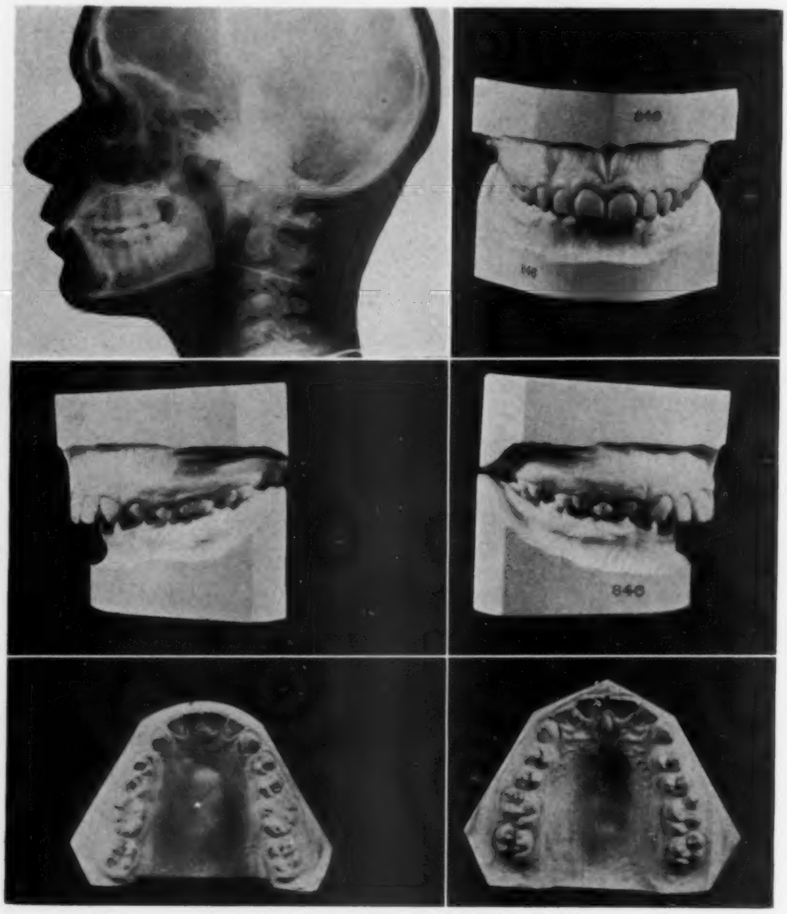

Fig. 3.—Headplate x-ray and models of a Type B, subdivision I case.

Subdivision 1: Cases that exhibit adequate growth of the body of the mandible to accommodate the teeth in positions of balance and normal relation (Fig. 1).

Subdivision 2: Cases that exhibit inadequate growth of the body of the mandible to accommodate the teeth in positions of balance and normal relation (Fig. 2).

Type B.—Cases in which the mandible is favorably positioned, anteroposteriorly, in relation to cranial anatomy. This type may be subdivided:

Subdivision 1: Cases that exhibit adequate growth and development of the body of the mandible to accommodate the teeth, but present a distal relation to the upper denture due to forward positioning of the upper dental units (Fig. 3).

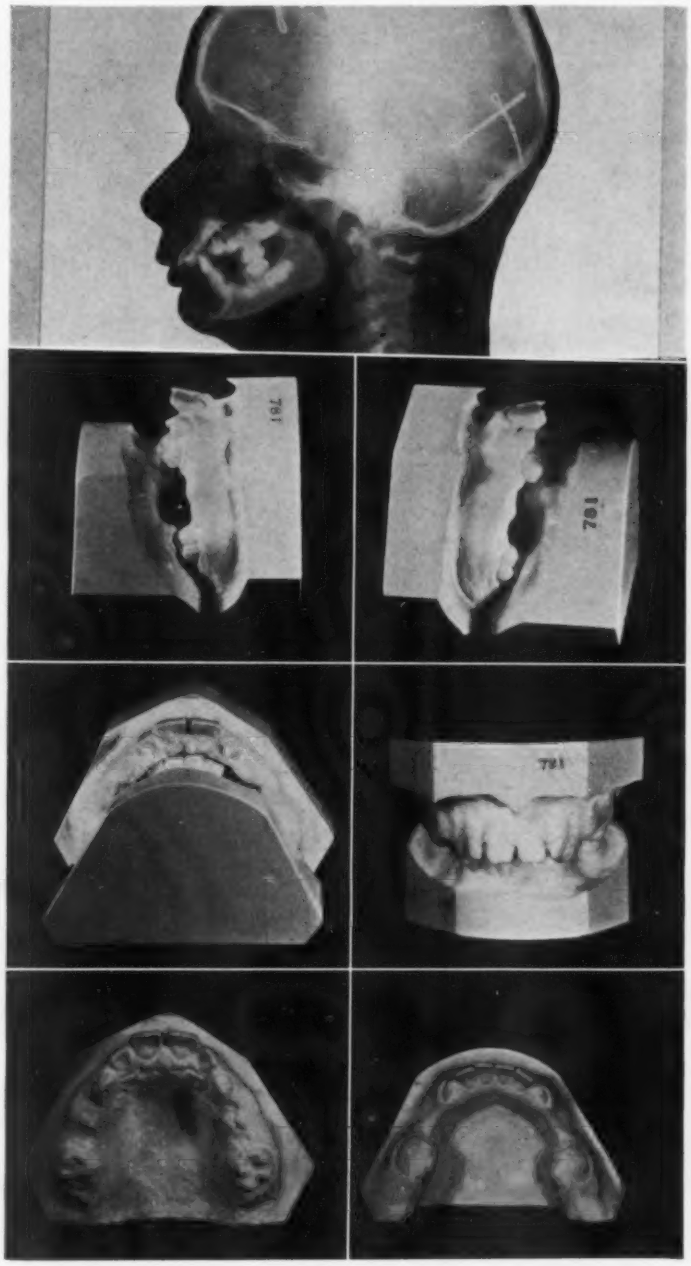

Fig. 4.—Headplate x-ray and models of a Type B, subdivision II case.

Subdivision 2: Cases that exhibit inadequate growth and development in the body of the mandible to accommodate the teeth in positions of balance and normal relation (Fig. 4).

Type C.—Cases in which the mandible is favorably positioned, anteroposteriorly, in relation to cranial anatomy with adequate body length and ramus width, measured from the chin point to the posterior border of the ramus, but the teeth and their associated alveolar bone are distally located on the mandibular base (Fig. 5).

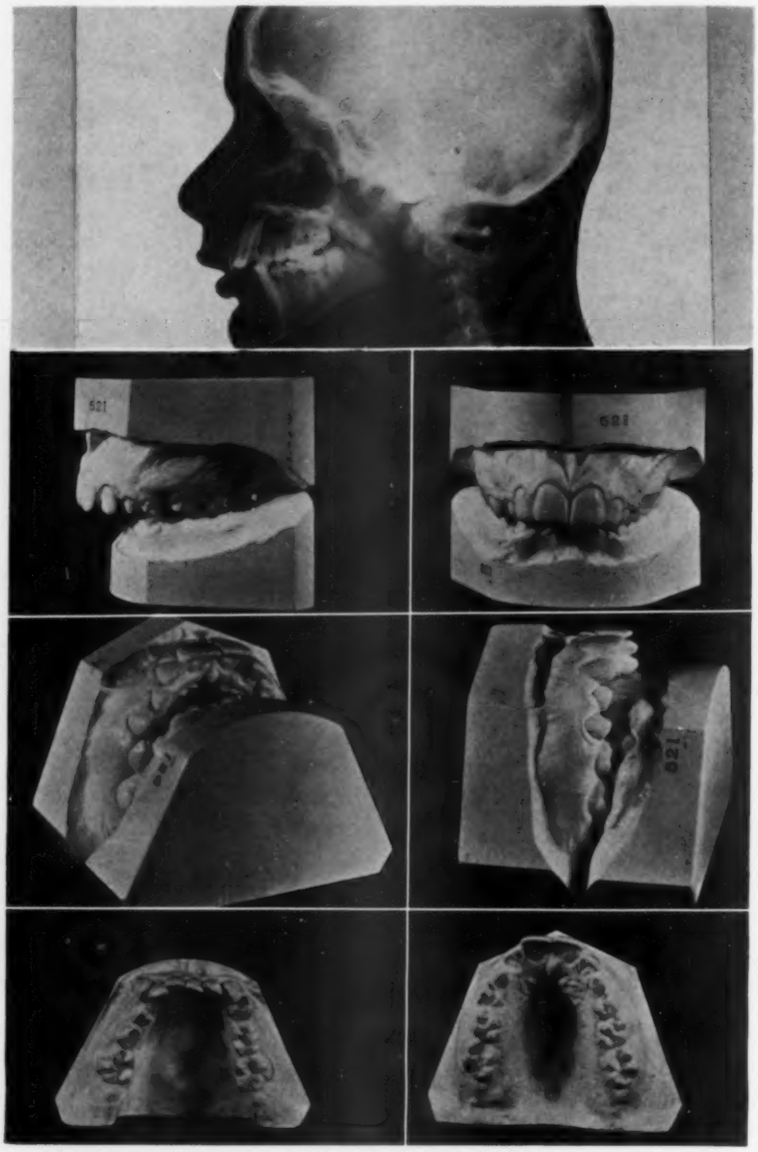

Fig. 5.—Headplate x-ray and models of a Type C case. Observe the lower anterior teeth and alveolar structure in relation to the chin point. In Types B and C cases observe the space between the posterior border of the ramus in relation to the vertebral column and compare this with the Type A cases.

The cases studied for this presentation indicate that Type A cases and the subdivisions seem to occur less often than Type B. However, it may be that the study of a large statistical sample of cases will reveal that Type A occurs almost as frequently as Type B, and that Type C cases are the unusual.

This concept of Class II malocclusion analysis is an attempt to develop a better understanding of the problem. To some practitioners it may be of no value; however, in my experience it has been helpful in understanding the various difficulties to be encountered and thus I am guided in planning treatment procedure to obtain satisfactory results. By proper technique procedures the headplate x-rays will disclose the outline of the soft tissues in relation to the osseous structures. This will reveal the character of these tissues and their influence on the underlying parts, whereas photographs or observation of the patient alone will not show the true status of this tissue relation. Furthermore, by studying the headplates the need for proper myofunctional therapy can be determined and an effective corrective routine instituted to overcome the adverse influence of the perverted muscular function which has been active and will continue to be detrimental to the stability of the completed case if it is not overcome by the time the active treatment is finished.

Thus far no reference has been made to the analysis of the maxillary portion of the malocclusion, because of the basic importance of the lower jaw and denture. Dr. Angle, in his consideration of the forces governing normal occlusion, said, "Harmony between the complete upper and lower arches is also powerfully promoted by their normal action and reaction upon each other through the teeth. As the teeth of the lower arch erupt before their antagonists of the upper arch and are consequently to an extent fixed in their positions before the latter appear, it follows that the lower arch is the form over which the upper is molded. In other words, the lower arch exerts a modifying influence on the form of the upper. Of course, the upper reacts upon the lower, but it is unquestionable, in the author's opinion, that the lower arch is the more important factor in determining the form of the dental arches than the upper. . . ."[7]

If nature in establishing normal occlusion follows the plan of adjusting the lower denture in the osseous structures first, to act as a guide or pattern to accomplish harmonious relation between the upper and lower dentures, then it seems logical that in analyzing malocclusion the mandible and the superimposed denture should be analyzed first so a basis of reference can be established against which the necessary changes of the upper denture can be compared or harmonized.

The chief factors to be considered in the maxillary portion of the headplate are:

1. The over-all relation of the osseous structures of the maxilla and the denture with the mandible and the dental units located therein.

2. The axial inclination of the upper incisors.

3. The amount of overjet or forward position of the upper incisors in relation to the lower incisors.

4. The relation of the outer border of the alveolar plate covering the apical third of the central incisor compared with the incisal edge of the tooth.

5. The measurement of the maxilla from this apical third area to the distal of the maxillary tuberosity.

While headplate x-rays reveal much that cannot be clearly disclosed by other means they should not be considered to be the all-inclusive method of

analysis. The source of exact reproduction of the parts upon which the orthodontist must operate is to be found in the models of the case. These must be exact models, as described previously under assemblage of data for case analysis. To obtain these, compound or other plastic impression materials are not satisfactory. Hydrocolloid or alginate impressions, carefully taken, will give exact models if the impressions are poured immediately after they are taken. From such models exact measurements of the teeth and associated parts can be obtained because there is not the confusion of superimposed teeth and other structures which are inescapably present in headplate x-rays. These measurements should be compared with the same areas on the x-rays to determine if there is adequate space to accommodate the teeth that need to be relocated. There can be little doubt that there is a definite ratio of tooth quantity to supporting bone quantity in a normally developed mouth and dental arches. Just what the ratio is cannot be easily demonstrated. However, it is a well-established fact that the foundational base of a structure must be adequate to support and withstand the stresses brought to bear upon it, if the structure is to remain in good condition and serviceable through a reasonable period of time. The dental mechanism is no exception to this rule; therefore, the apical bony base must be adequate to support the amount of tooth material transmitting stresses to it. Consequently we must use a method of studying and analyzing the proper relation of tooth quantity to the available apical bony base. This apical bony base is frequently referred to as the basal bone, and it may be described as that area of bone tissue of the jaws which will remain after the permanent teeth have been removed and normal alveolar absorption has been accomplished. The question which naturally follows is, "How shall we measure tooth and bone quantity?" There is no difficulty about the measurement of teeth for they can be measured in the mouth, on models and x-rays. The measurement of bone quantity is not so easily accomplished. However, I shall present a method which is reasonably reliable and based upon observations of patients in both general and specialized practice and the measurement of cases before and after treatment. In a study of x-rays of mouths where some permanent teeth have been removed, it can be noted that approximately the bone which surrounded the apical third of the removed tooth remains. To me this seems to indicate that this is the area of alveolar and basal bone union and also the most stable part of a tooth's position in the bone, and the part nearest to its normal location; it then follows that it is a reliable and basic area from which to make our measurements.

Now let us proceed with this method of analysis.

ARMAMENTARIUM

The following instruments and accessories are required: Drawing set, outside measuring calipers, compass, millimeter rule, millimeter graph paper, cloth or cards and pieces of Plexiglas, gauge 0.060, cut 3 by 3½ inches, and exact models of the case. The standard method of trimming is used and the teeth must occlude in their proper centric occlusal relationship when the models are set on the posterior base. The base must be at right angles to the midline of the denture.

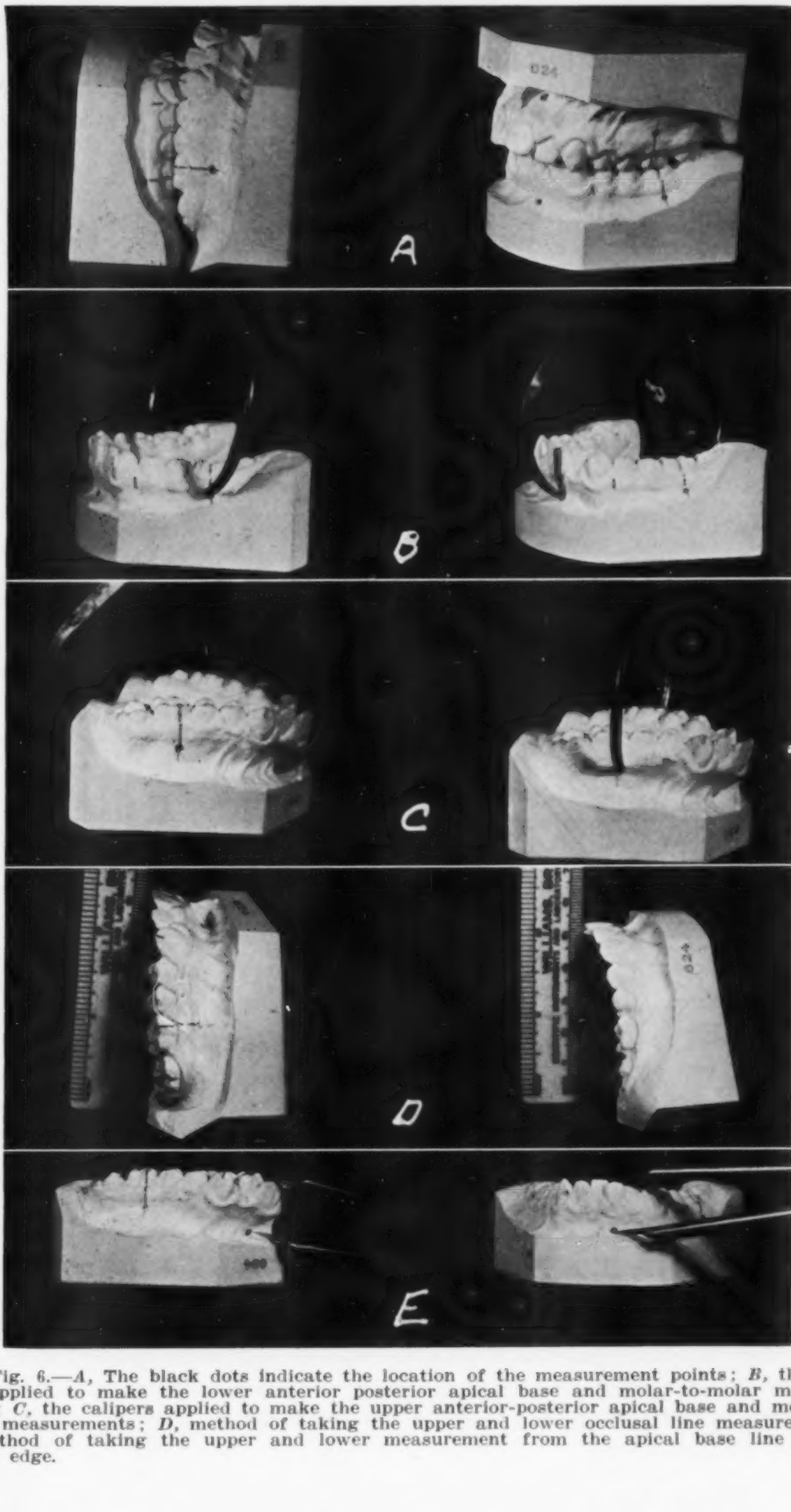

Fig. 6.—*A*, The black dots indicate the location of the measurement points; *B*, the calipers applied to make the lower anterior posterior apical base and molar-to-molar measurements; *C*, the calipers applied to make the upper anterior-posterior apical base and molar-to-molar measurements; *D*, method of taking the upper and lower occlusal line measurements; *E*, Method of taking the upper and lower measurement from the apical base line to the incisal edge.

METHOD

All measurements must be taken accurately, labeled, and recorded on millimeter graph paper, cards, or drawing cloth. The outside caliper is used to measure the areas shown in Fig. 6, *A*. The one caliper point is placed over the labial alveolar plate at the junction of the apical third and the incisal two-

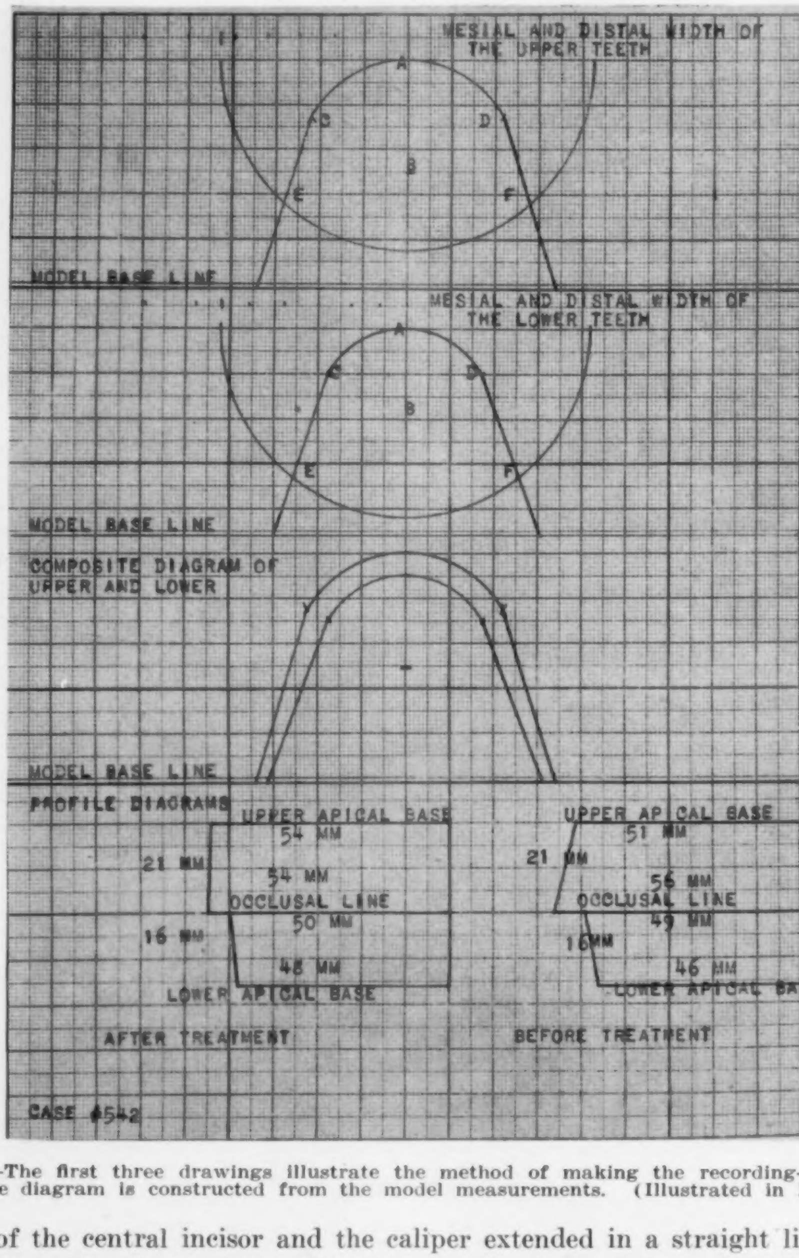

Fig. 7.—The first three drawings illustrate the method of making the recording-plex. The profile diagram is constructed from the model measurements. (Illustrated in Fig. 6.)

thirds of the central incisor and the caliper extended in a straight line to the place where the other point touches the posterior base of the model (Fig. 6, *B*). This measurement is designated as the anterior-posterior apical base line. Then the points of the caliper are placed at the apical third of the first molars on a

line extending from the mesial buccal groove of the lower first molars (Fig. 6, *B*). This measurement extends across the model from the right molar to the left first molar. The procedure is the same for the upper dental arch except that the molar measurement is made on the line extending from the ridge of the mesial buccal cusp of the upper first molars (Fig. 6, *C*). In all measuring the caliper points should be kept parallel with the model base. Next stand the model on the posterior base and measure from the posterior base to the labial incisal edge of the central incisor (Fig. 6, *D*). This measurement is designated as the occlusal line. Then measure from the incisal edge to the anterior point of the apical base line (Fig. 6, *E*). By placing these measurements of the upper and lower models on graph paper and connecting the points with lines, a profile diagram of the case will be constructed (Fig. 7). From this composite the degree of axial inclination of the incisors and the anterior-posterior relationship of the upper and the lower dentures can be observed.

Finally, measure and record the actual mesiodistal dimension of all the crowns of the upper and lower teeth and indicate the buccal ridge of the mesial buccal cusp of the upper first molar and the buccal groove of the lower first molar. Figs. 6, *A* and 7 illustrate the location of the measurement points and the diagrams constructed from these by the method to be described.

MAKING THE RECORDING-PLEX

A piece of Plexiglas is marked with a scratch mark down the center of the 3½ inch dimension at right angles to the base. This is to be used as the median line of the denture. The lower central apical third posterior model base measurement is now recorded on the recording-plex by measuring from the posterior edge; at the proper distance, the compass point is pressed into the Plexiglas to make point *A* on the midline scratch mark. The compass is now set for the combined mesial distal width of the central and lateral incisors and canine. With the compass point at point *A*, the radius of a circle is scratched on the midline to make point *B*. The compass is then transferred to this mark and the segment of a circle is now scratched into the recording-plex, then the compass point is returned to point *A* to make scratch marks *C* and *D*.

The compass is set for the mesial distal width of the incisors, canines, premolars, and the mesial of the first molar to the mesial buccal groove in the lower, and with the point at *A*, a scratch mark is made to extend beyond the width of both the upper and lower molars. Now the molar-to-molar measurement is divided in half, and the compass point is moved along the midline of the recording-plex with the drawing point parallel to it. Where the drawing point meets the molar-to-molar scratch mark just previously recorded, the measurement is marked on both sides of the midline and indicated as *E* and *F*. Now a line is extended from points *C* and *D* through *E* and *F* to the base edge of the recording-plex. By setting the compass to the measurements of all the teeth, scratch marks are made across the lines just inscribed. These will indicate the location of each tooth and the amount of space it will require in the arch. The same procedure is followed in forming the upper recording-plex except the location of points *E* and *F* is determined by setting the compass for the mesial

distal width of the central incisors, lateral incisors, canines, premolars, and the mesial of the first molar to the ridge of the mesial buccal cusp. By inking the scratch marks with black India ink in the lower, and red in the upper, the lines can be seen easily and their locations quickly related to the model.

The recording-plex is now prepared and ready for use in making the analysis of the case. Place the recording-plex over the occlusal surfaces of the lower teeth with the median scratch line superimposed over the median line of the model and the posterior edge parallel with the posterior base of the model (Fig. 8). The black outline gives the area into which the lower teeth may be moved laterally and anteriorly without being placed beyond the basal bone. The posterior edge of the plex indicates the posterior base of the model and is the limit of distal movement. In most cases, it is beyond the limit of posterior tooth movement. By noting where the mesial distal tooth marks cross in relation to the actual tooth positions on the model, the question of if and what tooth or teeth should be removed can be determined. The same procedure is used with the upper model.

When this method of analysis is applied to cases it is readily noted that the amount of lateral movement of the teeth is very limited if correct basal bone relationship is to be maintained. Also, to retain the full complement of teeth will require a great amount of distal movement if correct basal bone relationship is to be preserved. Many times the amount necessary is beyond any reasonable expectation. Where tooth removal is required, it will be found that little, if any, change is necessary in the lateral dimension in the molar and premolar areas. Most of the change necessary is in the anterior segment.

All of the foregoing analysis has been on the basis of zero axial angulation of the anterior teeth. While this goal is not desirable or possible in all cases, it is better to make this the basis of analysis, for if this goal is reached, the case will be modified favorably by the forces of occlusion when retention is discontinued.

The principal advantages of this adjunct to case analysis are:

1. It provides a visible guide in outlining the areas and limits of tooth movement.

2. The exact measurements of the teeth are recorded in arch form so the size and balance of the dental arch are predetermined.

3. By superimposing the recording-plex over the model of the malocclusion, the ratio of tooth quantity to alveolar bone quantity can be determined.

4. Where tooth quantity exceeds the limitations of alveolar bone accommodation, it is readily visible.

5. The quantity of tooth material alteration can be determined by exact measurement over the malocclusion.

6. Further application of this method in conjunction with a more thorough knowledge of the growth and development of the face, jaws, and the teeth will be an aid in early treatment and the prevention of prolonged orthodontic treatment.

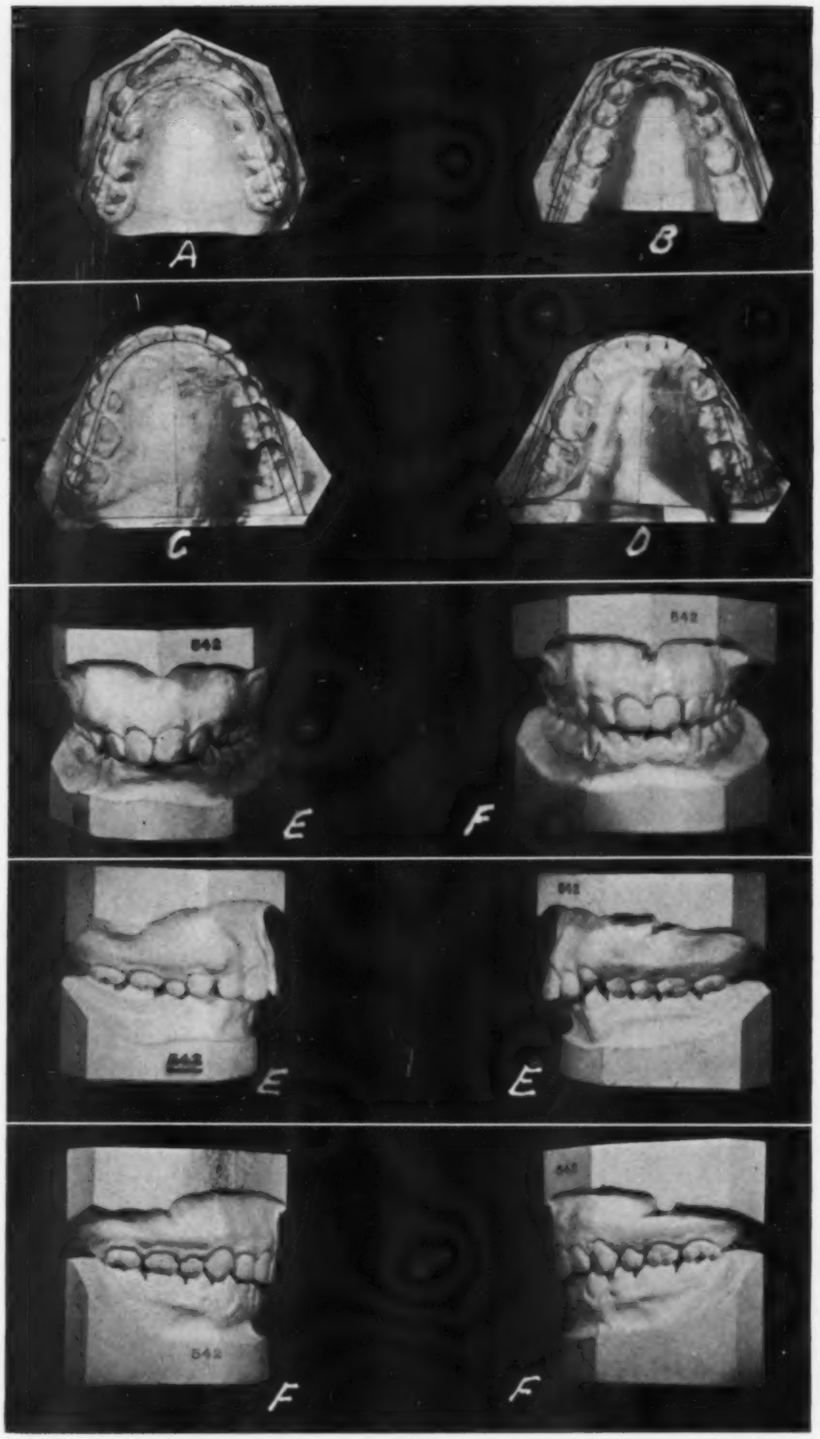

Fig. 8.—The recording-plex is placed over the original malocclusion and outlines the area into which the teeth must be relocated, *A* and *B*. The same recording-plex is placed over the treated case, *C* and *D*. Note that the teeth are within the area for both upper and lower. In *C*, observe how the outline for the lower denture is in line with the proper occlusal relation in the upper. *E* and *F* are models of the case before and after treatment.

SUMMARY

1. Evaluation is concerned with the initial consideration of a case and analysis is the process of determining all the factors involved in preparing for the successful treatment of the case.

2. Present-day concepts of orthodontics must include more than classification and appliance design. They must cover a deeper study of the basic causes of the problem and an understanding of the limitations of treatment.

3. The history of the patient as well as a dental history of parents and grandparents is most valuable in appraising the future developmental possibilities of the patient.

4. Cephalometric x-rays reveal the osseous structures which support the dental units and those associated parts which as a whole have contributed to the condition we are called upon to treat. It is essential to examine the parts of the cranial and facial complex to determine wherein inadequacies exist to disturb the optimum balance and harmony.

5. Class II malocclusions are the most variable of the three great classes. There seem to be several combinations of associated parts which occur as discernible types.

6. Cephalometric x-ray analysis should not be considered an all-inclusive method. Models of the case, carefully made, are the source of exact measurements for analysis for they are the reproduction of the parts upon which the orthodontist must operate.

7. Thoughtful consideration of all phases of case analysis is essential to establishing a plan for successful treatment.

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HEAT TREATING STAINLESS STEEL FOR ORTHODONTICS

W. A. Backofen* and G. F. Gales,** Boston, Mass.

THE kind of heat treatment discussed in this paper seems to be relatively new in orthodontics. Dr. Emery Fraser described this heat treatment in 1949 at the Charles H. Tweed Foundation for Orthodontic Research. He pointed out that annealing, after forming, for a short time at a low temperature should bring about an over-all improvement in the effectiveness of stainless steel appliances. Since then there has been some discussion of just how worth while the heat treatment really is and what it actually accomplishes. And that discussion is what prompted the experiments that are presented here.

Now there is already a large amount of information available about the low-temperature heat treatment of stainless steel.[1-6] This was obtained in a number of earlier studies by metallurgists and mechanical engineers who were looking for a solution to the following problem: Because of the nature of stainless steel, it can be strengthened only by a kind of permanent, or plastic, deformation known as cold-working. Examples of practical processes for cold-working and strengthening are ordinary rolling and wire drawing. Treated in such a way, stainless steel may acquire a very high tensile, or breaking, strength. But although strong in this respect, the stainless steel is frequently deficient in another kind of strength—to be defined very shortly—that is best described as elastic strength. Here was the incentive for the studies that have very convincingly shown that proper heat treatment is the most effective way of improving the elastic strength of cold-worked stainless steel.

Heat treatments varying from anywhere up to thirty minutes at 950° F. to 100 hours at 400° F. have been recommended. The lower temperature heat treatments get around the discoloration caused by annealing at the higher temperatures and eliminate any chance of impairing corrosion resistance. It is not often easy to avoid discoloration when the temperature is in the upper part of that range, but test results have been reported which show that short times at the higher temperatures should not be expected to alter corrosion resistance.

In spite of the underlying similarity, there still is not too much direct overlap between the earlier work and the contents of this paper. The one important difference is that here we are concerned with severely cold worked orthodontic wire which really has not received much attention. Another thing this paper will cover is some experiments with a fairly typical arch wire construction. And the results do provide information helpful in evaluating the worth of the low-temperature heat treatment in orthodontics.

Read before the Annual Meeting of the Northeastern Society of Orthodontists, Hotel Commodore, New York, N. Y., March 4, 1952.

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Definitions are usually rather lifeless to be sure, yet a paper centering around mechanical behavior lacks precision without them. The important ones concern stress and strain. Although it may be all right to interchange stress and strain in everyday language, each has a very definite meaning as far as a metal is concerned.

Stress is the intensity of a force and it is calculated by dividing a force by an area. Fig. 1 shows what is meant by stress. The cross-sectional area of the bar is one square inch, and the weight or force on the lower free end is 1,000 pounds. Therefore, the stress which is acting everywhere over any cross section and trying to extend the bar is 1,000 pounds per square inch (psi). Every single particle of the bar is subjected to this tensile stress of 1,000 psi. The several arrows drawn on one particular cross section are intended to illustrate this point. If F is doubled, the stress increases to 2,000 psi. A two-fold increase in stress could also be brought about, keeping the same force of 1,000 pounds, by simply replacing the one-inch square tensile specimen with one only one-half square inch in cross section. Stress is the quantity which actually determines how much a piece of metal deforms. Forces create stresses, but the magnitude of a stress is determined by how large an area a particular force is acting upon.

The tensile stress in the bar of Fig. 1 will cause it to lengthen. Fig. 2 shows, with considerable exaggeration, how much extension there will be in a steel bar 1 inch square and 12 inches long when the stress is 1,000 psi. The length increase is 4 ten-thousandths (0.0004) of an inch. If the bar were 24 instead of 12 inches long, the extension should be 0.0008 inch or twice as much. We can get around having to specify the length of the tension specimen when talking about extension by describing the extension as so many inches per inch of length. And this is the definition of strain. The strain in the bar of Fig. 2 is 3.3 one hundred-thousandths of an inch per inch (0.000033 inch per inch). When the 1,000 pound force is removed, the bar quickly contracts to its initial length. Such recoverable deformation is termed elastic. It is the same kind of deformation that we observe when a rubber band is stretched and then released. As the stress is increased, the strain increases in proportion. If the stress is doubled, the strain is also doubled. This response of strain to stress is the fundamental characteristic of elastic deformation.

The elastic behavior of a metal bar stressed in tension is easily pictured with a graph like that in Fig. 3. The straight line in this graph describes the relationship between elastic stresses and strains. If stress does not exceed the value σ_t, the strain is elastic and completely recoverable when the force responsible for the stress is removed. The straight line does more than just relate elastic stresses and strains, however. Its slope gives us a measure of the stiffness of a metal. As an example, the slope for stainless steel is nearly twice as steep as the slope for a common gold alloy. And if two wires of the same size are compared by simply bending them, we would experience nearly twice as much stiffness in the stainless steel wire. The slope of this line, or the measure of stiffness, is called the elastic modulus.

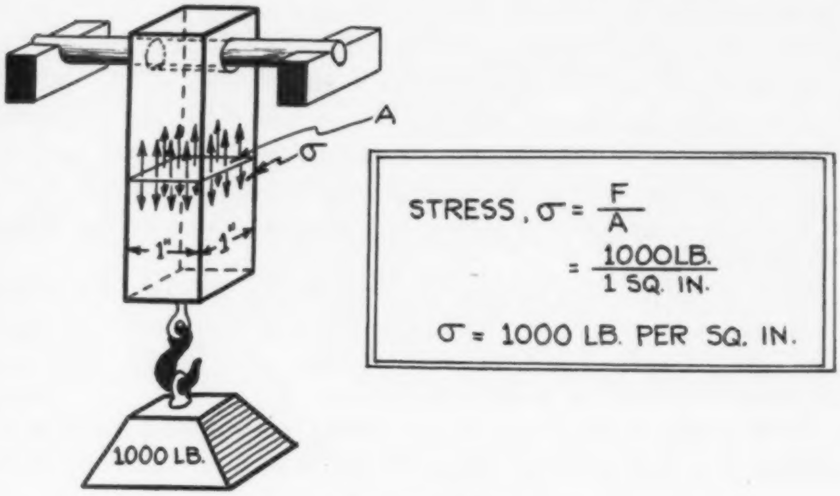

Fig. 1.—Stress.

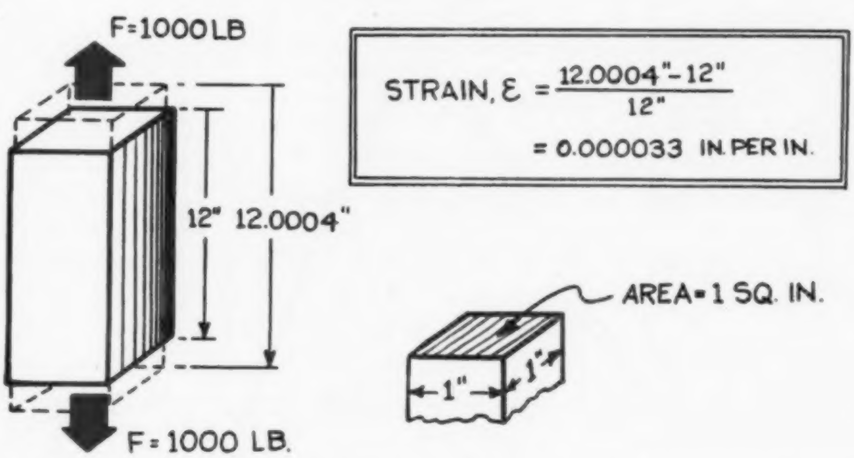

Fig. 2.—Elastic strain in a one-inch square steel bar subjected to a stress of 1,000 psi.

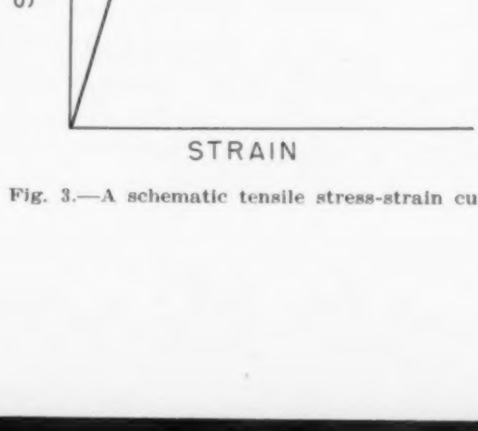

Fig. 3.—A schematic tensile stress-strain curve.

Now there is an upper limit on how much stress a metal will withstand and still deform only elastically. On the stress-strain curve in Fig. 3, σ_t is this upper limit. When the stress becomes larger than σ_t, the curve bends sharply to the right and stress and strain stop being directly proportional to one another. If a bar is unloaded after being subjected to some stress greater than σ_t, it will not contract to its original length. We would find that such a bar has acquired a permanent increase in length, which means that it has deformed plastically.

For every metal there is another limiting stress. But this one can only be reached; it cannot be exceeded. When it is reached, a bar loaded up in tension undergoes very localized plastic deformation and finally breaks. This maximum stress is called the tensile strength.

The total strain in the bar when it breaks, multiplied by 100, is a fairly good indication of a metal's ductility and referred to as the per cent elongation.

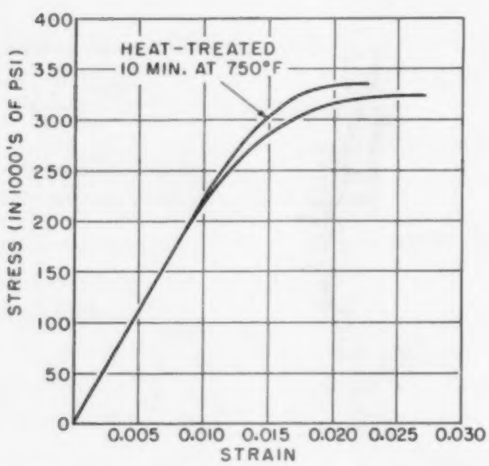

Fig. 4.—Tensile stress-strain curves for 0.020 inch round wire in the as-received condition (lower curve) and after heat treatment for ten minutes at 750° F. (upper curve).

The stress-strain curve of Fig. 3 is, of course, schematic. There is no difficulty in deciding what the elastic strength of this imaginary metal is. It is simply equal to the stress, σ_t, at which the metal finally starts deforming plastically. In most real metals, however, the transition from elastic to plastic deformation is nowhere near as well defined as it is here. And the expression "elastic strength" sometimes requires more precise definition.[9] But we can avoid the precise definitions if we just think of elastic strength not as a clear-cut stress, but instead as the resistance that a metal offers to the beginning of plastic deformation.

The tensile behavior of a real metal is illustrated in Fig. 4 which contains stress-strain curves for 0.020 inch diameter stainless steel wire. The lower curve was obtained with wire in the as-received condition; the upper curve after annealing this wire for ten minutes at 750° F. It is quite apparent that the curve for the heat-treated wire does not bend over to the right as fast as

the curve for unheat-treated wire. This is the most important difference between these curves, and it means that an appreciable increase in elastic strength has resulted from the heat treatment. More time will be taken later on to emphasize the significance of this increase.

EXPERIMENTAL WORK

We have just seen what a ten-minute heat treatment at 750° F. does to the stress-strain curve of a cold-worked wire (Fig. 4). Fig. 5 illustrates the effect of different heat treating temperatures on the stress-strain curve. The specimens for these tests were straight 5-inch lengths of 0.021 by 0.025 inch rectangular wire. The lowest curve represents the "as-received" condition and the other curves, heat treatments of twenty minutes at 500° F. and ten minutes at 750° F. and 820° F.

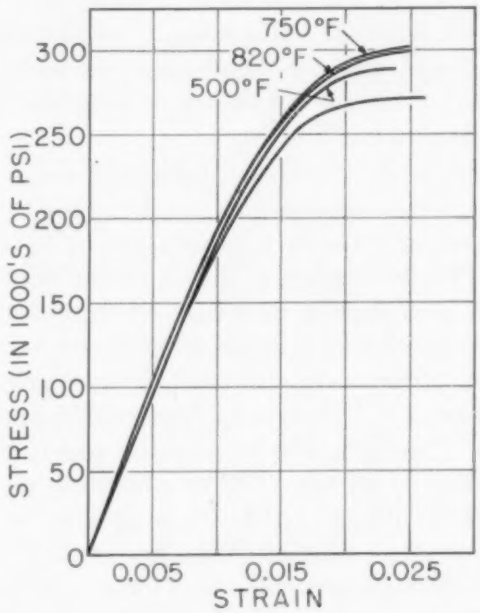

Fig. 5.—Tensile stress-strain curves for 0.021 by 0.025 inch rectangular wire in the as-received condition (lowest, unlabelled curve) and after heat treatment of twenty minutes at 500° F., and ten minutes at 750° F. and 820° F.

Once more a marked increase in elastic strength turns out to be the most important effect of heat treatment. It is also apparent that the increase is more pronounced after heat treatment at the higher temperatures. The position of the 820° F. curve slightly below the 750° F. curve hardly seems significant, however. Subject to the accuracy of the testing, it was difficult in the many tests carried out to observe any consistent difference between the curves for these temperatures.

A number of time-temperature combinations were tried, and five specimens were tested for nearly all of them. The temperatures were those noted in Fig. 5. But the time at temperature was varied from three minutes to two hours. Generally the heat treatments represented in Fig. 5 were adequate for repro-

ducible test results, and longer times did not bring about further changes of any consequence. However, conclusions about the proper time-temperature combination must be tentative; this work was concerned primarily with the effect of heat treatment and only secondarily with optimum heat treating conditions.

Wire from several sources was tested in this way. But there is very little to be gained from more stress-strain curves. Those in Fig. 5 are perfectly typical of all that were collected.

Of course, a straight length of wire is not exactly equivalent to an orthodontic appliance. Therefore, to meet any such objection to tension testing, and also to obtain more direct measurements of the effect of heat treatment, the next experiments were carried out with closing loops formed from rectangular wire. The closing loop was selected as a typical arch wire construction, and, at the same time, was a very convenient test specimen. Two kinds of loops were used. In one, type A, the legs were brought into contact, while in the other, type B, the legs were parallel and separated by about $\frac{1}{64}$ of an inch. The dimensions and shape of the loops before testing are shown in sketches, drawn roughly to scale, that are included in Figs. 6 and 7.

The loops were supported by the upper hook and weights were attached to the lower. The heavy arrows represent the force applied to the loop in this way. Two reference marks, a distance L_o apart (about $\frac{1}{8}$ of an inch), were scratched on each loop. Their location is shown in the sketches. L_o was accurately determined with a measuring microscope before the test. In testing, the weight on the lower hook was increased by small amounts, and, after every addition, the larger distance, L_L, between the two reference marks was measured with the microscope. In this way, between 15 and 20 observations were made in most tests. The difference between L_L and L_o divided by L_o and multiplied by 100 is described as the "per cent deflection" and is simply a measure of how much the loop is opened by some applied force. To visualize the leg separation in units more tangible than per cent deflection, we might note that a 40 per cent deflection means the legs have separated by an amount roughly equal to the thickness of a ten cent piece.

Force-deflection curves for eight A loops tested without heat treatment are presented in Fig. 6. The loops broke through the bend either as the last increment of weight was added or immediately after. It was impossible, therefore, to observe the force and deflection at fracture. The curves are extended with dashed lines to indicate this condition. The encircled numbers for the different curves represent the per cent deflections remaining in the loops after the force was increased to 1.76 pounds and then removed. The 1.76 pound force has no special significance. It just happened to be convenient to change the weight on a loop once it had built up to this amount.

All of the A loops were formed by an orthodontist with conventional instruments and were made as nearly alike as possible. But despite a careful preparation, Fig. 6 reveals a sizable variation in the force-deflection characteristics of the individual loops. Notice that one broke with only about 0.70

pound and less than 40 per cent deflection. The reason for this is the variable amount of cold-working that can be introduced into the bend when pinching it with pliers to bring the legs into contact. The cold-working may be just sufficient to close the loop, but it could easily be greater than the necessary

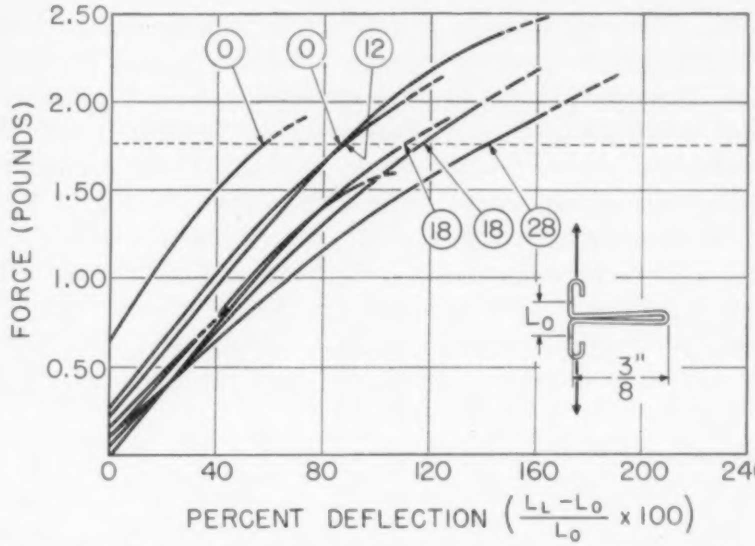

Fig. 6.—The force-deflection characteristics of typical unheat-treated closing loops.

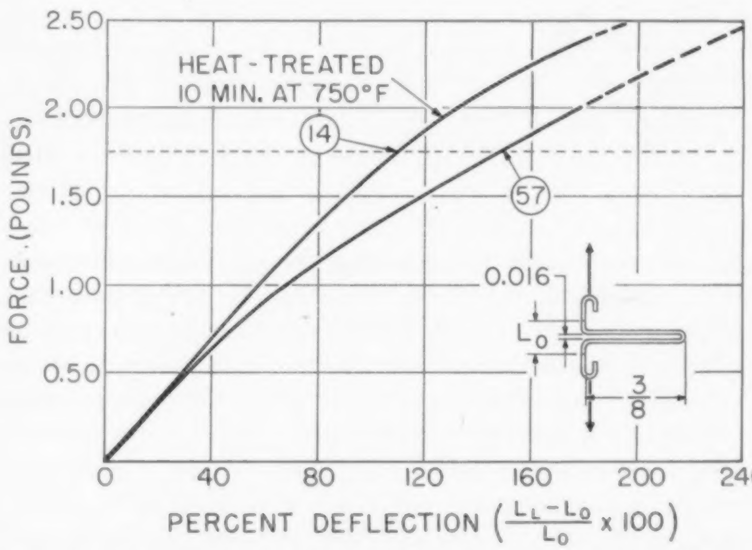

Fig. 7.—Averaged force-deflection characteristics of closing loops with separated legs after forming (lower curve) and after a heat treatment of ten minutes at 750° F.

amount, although the appearance of the finished loop would be the same in both cases. Loops of this type were not tested after heat treatment because of the very likely possibility that their nonuniform behavior would obscure the effects of heat treatment. This does not mean, however, that heat treat-

ment will be any less significant for such loops. But it would be difficult to make a "before and after" comparison if the characteristics of all were not approximately the same in the beginning.

After this experience with the A loops, the type B loops with separated legs were prepared and tested both before and after a heat treatment of ten minutes at 750° F. The cold-working of the bend in this kind of loop should be much less variable since the legs are separated and this spacing is effectively a gauge which determines when the bending should be stopped. A loop with more reproducible properties would be expected, and it actually turned out that the force-deflection characteristics of such loops were very much alike, so much alike that it was necessary to draw the curves in Fig. 7 through points obtained by averaging a number of measurements. Otherwise the curves would be so close together that the figure would not be particularly legible. The curves for the loops before and after heat treatment were drawn from the averaged results of four and five tests, respectively. The encircled numbers and dashed lines extending the curves have the same meaning that they had in Fig. 6.

Again a pronounced increase in elastic strength is the significant effect of heat treatment. The initial straight-line part of the curve for heat-treated loops is about twice as long as that for the unheat-treated loops. And the whole curve for the heat-treated loops bends over to the right much more gradually. The curves show very clearly that regardless of how far the legs are separated, a heat-treated loop is always stronger than an unheat-treated one. Even if a particular force is large enough to deform both loops so that neither recovers completely, the amount of permanent set left after heat treatment will be much less. Notice that the deflection remaining after the 1.76 pound force is removed is less by a factor of about 4 in the heat-treated loops.

DISCUSSION

Both the series of experiments just presented and a considerable amount of previous work have established, rather convincingly, that heat treatment does affect the mechanical properties of cold-worked stainless steel; in particular it causes a marked increase in elastic strength. There is good reason to conclude that in orthodontics, just as in other applications of stainless steel, it is the improved elastic strength that is most important.

To bolster this conclusion, we might consider a working appliance made elastically stronger by heat treatment. It is much more likely that all of the distortion in such an appliance will be elastic and recoverable. Eventually, the appliance will return to its original shape, but, all the while it is distorted, the forces that are being applied will be as large as possible. This certainly seems to be the most important benefit derived from heat treatment. Referring again to Fig. 7, we see that for any deflection greater than that at which the curves diverge, the heat-treated loop will apply the larger force and contain much less, if any, permanent deflection after the force is removed.

There are other changes in elastic modulus, tensile strength, etc., as a result of heat treatment, but these appear to be of only secondary importance.

We have already noted that the improvement in the elastic strength of cold-worked stainless steel by proper heat treatment is not exactly a new discovery from the viewpoint of the engineer who specializes in materials. Actually the response of many cold-worked metals to a low-temperature heat treatment is similar to that of stainless steel.[1, 7, 8] This general response most often results from the elimination of so-called residual stresses. These are stresses which remain "locked-up" within a metal even after the forces needed to produce cold-working are removed.

When later on another force is applied to the cold-worked metal, the actual stresses are the sum of (1) the residual stresses left over from the first cold-working operation, and (2) the stresses that are set up by the new force. This means that the stresses may be very high even though the applied force is quite small. As a result, plastic deformation may set in much sooner than would be expected if there were no residual stresses.

A closing loop is one of the best examples for illustrating this possibility. Residual stresses will invariably be present throughout the bend. And it is more than likely that those at the inside surface will be tensile, trying to pull the surface layers apart, while those at the outside surface will be compressive and trying to squeeze the surface layers together. Only a little effort would be required to prove that this really is the residual stress pattern. But it would take time and not contribute very much; so the simplest thing to do is just accept the description without more discussion. The sketches in Fig. 8 may help in picturing the consequences of the residual stress pattern. In the upper left-hand corner, the residual stresses after forming, and right at the surfaces of the bend, are represented by two springs fastened to a rigid I-shaped member. The inside spring is of the door-closing type. This one is stretched out and under tension just like the inside surface of the bend. The spring on the outside is the kind found in a bed spring; it is squeezed together and under compression thus representing the state of affairs at the outside surface of the bend. When force is applied to open the loop, as in the center sketch of the top row, the inside is subjected to more tension and the outside to more compression. Another pair of tension and compression springs is shown in the sketch to represent these new stresses which are added onto the residual ones already present. The net result is indicated in the upper right-hand corner. Although the force may be relatively small, the stresses in such a loop will be high because they are made up of the two parts, (1) residual and (2) applied. And the loop will not withstand much force before it deforms plastically and acquires a permanent deflection. When the residual stresses have been eliminated by heat treatment, the sequence of sketches in the lower half of Fig. 8 shows what happens. Now the only stresses come from the applied force; there are none to start with. Consequently much higher forces can be supported by the loop before it takes on a permanent deflection.

But suppose that this line of reasoning about residual stresses is applied to opening instead of closing loops. After some thought, we might be tempted

to conclude that residual stresses like those in Fig. 8 are useful now because they actually contribute to an increased elastic strength. However, such a conclusion should not be taken too seriously. In general, the various bends and turns that go into orthodontic wire produce much more involved residual stress patterns than the very simple one of Fig. 8. Therefore, it is reasonably safe to say that in the greatest number of cases wiping out residual stresses by heat treatment will be decidedly advantageous.

A stress-relief anneal is the common name for the heat treatment intended to do away with residual stresses.

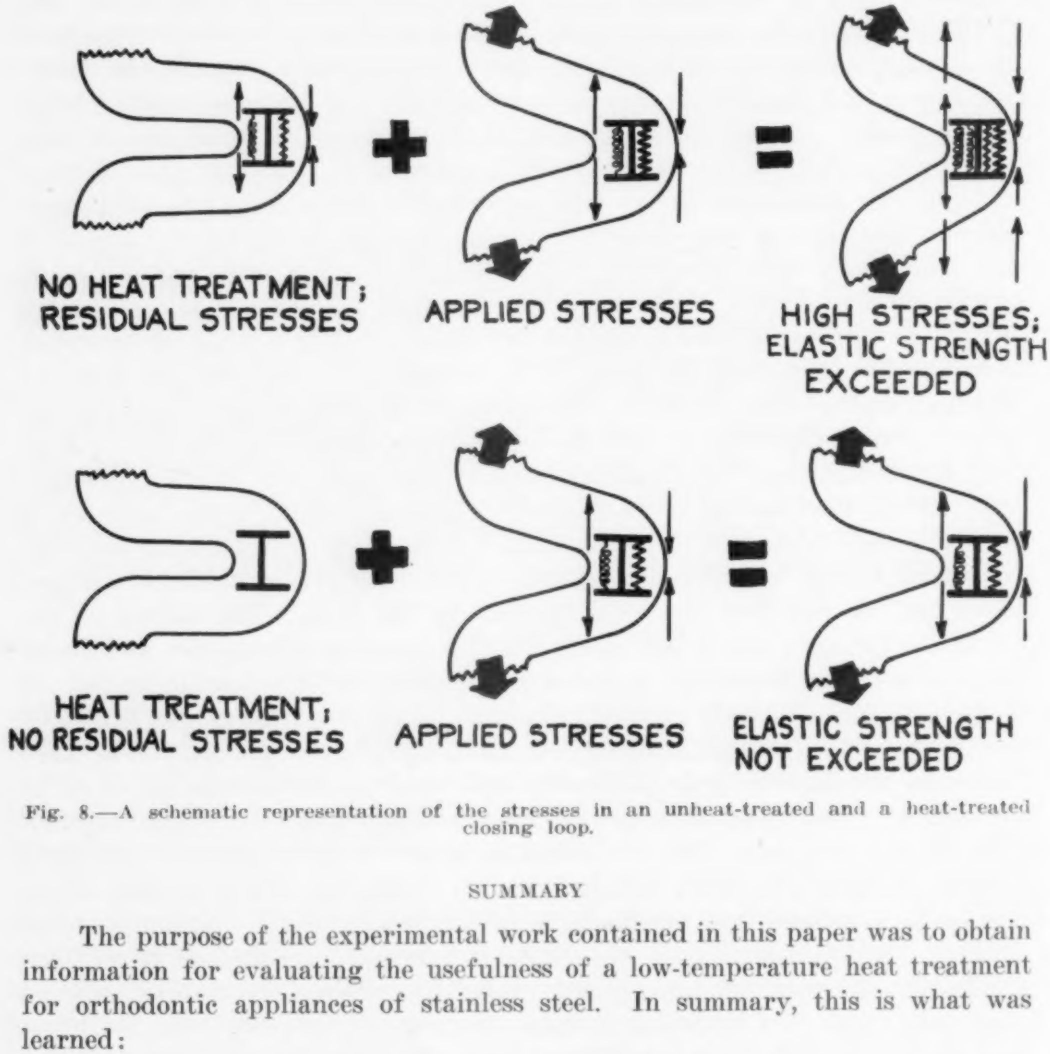

Fig. 8.—A schematic representation of the stresses in an unheat-treated and a heat-treated closing loop.

SUMMARY

The purpose of the experimental work contained in this paper was to obtain information for evaluating the usefulness of a low-temperature heat treatment for orthodontic appliances of stainless steel. In summary, this is what was learned:

1. Experiments with straight lengths of 0.020 inch round and 0.021 by 0.025 inch rectangular wire, and a closing loop formed from the rectangular wire, show that heat treatment does bring about changes in mechanical behavior, and in particular causes a marked increase in elastic strength.

2. From a limited consideration of heat treating conditions, it was found that twenty minutes at 500° F. and ten minutes at 750° F. and 820° F. were adequate for reproducible results; longer times seemed unnecessary. The effect of heat treatment at 750° F. and 820° F. was about the same, but somewhat more pronounced than at 500° F.

3. The increased elastic strength is the most significant effect of heat treatment. An elastically stronger working appliance is more likely to return to its original shape, not suffer any permanent deflection, and all the while it is deformed apply the largest possible force.

The authors are indebted to Professor Wulff of the Massachusetts Institute of Technology and Dr. Margolis of the Tufts Graduate School of Orthodontics for their helpful counsel and criticism during the preparation of this paper. The generosity of the several firms who supplied much of the stainless steel wire is gratefully acknowledged.

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LEGAL ASPECTS OF ORTHODONTIC PRACTICES

Michael A. Hayes, A.B., L.L.B., New York, N. Y.

I COULD quote from a talk that I delivered to one of the divisions of the American Association of Orthodontists approximately ten years ago, and at that time I mentioned that the subject which was "Orthodontics Is a Ripe Field for Malpractice Lawsuits" was an extremely proper one at that time. The reason for such an observation was that the economic conditions were at such a low ebb that the public became more and more litigious minded, and, as a result, grasped at every possible chance as a means of recovery. And so the conclusion was that the practicing dentist in general, and the orthodontist in particular, afforded a ripe field for lawsuits based upon malpractice. However, that would be error today, because the situation has completely changed.

Malpractice lawsuits are at an extremely low ebb in all fields, and in the field of orthodontics, at an almost nonexistent level. You, as practitioners, are curious to know what is expected of the orthodontist in his practice. In order to understand more clearly the effect of dental jurisprudence, as it exists today, it is well to consider the historical development, at least superficially, and the specialties associated with it.

Many years ago, before the profession became identified, life was simple, and so also were its accompanying businesses and social intercourses. At that time, it was the question of might being right and the rule of existence was governed by the expression "the survival of the fittest." Infant mortality was high; adolescence existence, in many instances, fairly short, and adult survival, at a fairly low level. Conditions of health were unknown and ignored, and because of man's mode of existence, there was no exchange of duties and obligations, with respect to hygienic assistance and progress. However, a time came when those who took care of the spiritual ills of the people recognized the necessity for giving some attention to the physical ills. So, men of the cloth assumed this obligation, and, to a degree, there came into being what was subsequently developed into the medical profession.

Following this procedure the death rate was, to some degree, lowered; the population increased; business increased; and there developed, over a period of time, a complexity of existence as the result of this progress. As this advance continued, discoveries in the betterment of the relationship, from a business point of view and a health point of view, improved. When the relationships were recognized, certain duties were assumed on the one hand, which created obligations on the part of others. The more progress, the more duties came into existence, and, correspondingly, more obligations ensued.

A time was finally arrived at when medicine had to break away, and did, from the religious, and became identified by itself. They could not, with the

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rapid progress, learn and retain all the scientific discoveries and at the same time attend to their pre-existing religious duties. So the barber took over the medical progress, and finally the medical man, and, subsequently, the transition of the profession reached the point where there was a resultant subdivision of medicine and dentistry.

When the dentist came into existence, he, in theory, brought to the attention of the public, which constituted the State, that he was ready to treat members of the public individually. This was, in fact, holding himself out as a dentist, and so the State was interested to see that he had certain qualifications as a background and foundation for his practice. It meant that he studied in various schools which had requirements that were acceptable to the State. It meant he had finished these courses and benefited therefrom.

In the beginning many laxities were allowed to exist, and unrecognized institutions graduated men of dentistry, and, unqualified as they were, they were allowed to exploit themselves on the public, regardless of their insufficient background and qualifications.

There came a time, however, when the State realized if that condition was to continue it would lead to epidemics and pandemics, so the State systematized the requirements as to background and created a check on qualifications, and saw to it that before a certificate to practice was issued the man was definitely qualified. I suppose you wonder by what virtue of right the State could inject itself in this manner. While the State, you will concede, had a vital interest in its own existence, and as part of this existence the people of the State and their health was of extreme importance, and since the dentist, to a degree, controlled the ultimate health of the people of the State, the State then invoked what is nebulously known as Police Powers. It, at that time, brought under its supervision those men and women desirous of practicing dentistry within the confines of the respective States, and it, in substance, said to such aspirant, "If you expect to hold yourself out to the public as a dentist, we insist that you meet certain requirements, and, as a State, we are going to see, by examination and otherwise, that you fill these requirements."

Rules were then drawn up which specified certain educational requirements prior to the entrance to the dental school, and the failure to meet these requirements meant curtailment of further studies in the field of dentistry.

Thereafter, certain schools were authorized by respective states to instruct men desirous of engaging in that particular vocation, and those schools and their curricula were supervised by a Board, known in the State of New York as a Board of Regents, and, after completion of such course, an examination was given by the State Board of Regents to see whether or not the individual who had completed his studies should be given a license to practice.

The Attorney General's office in the State of New York is continuously on the alert to apprehend unlicensed practitioners.

Once the license was issued, the authority to practice was not given in an unlimited fashion, because if a dentist was to retrogress or remain static, it could readily be seen he would be useless or dangerous in his ministrations to

the public, and, while there was no particular written statute indicating the conduct of a dentist from that point on, there are requirements by legal interpretations and ethical codes of dental societies. These requirements have been the result of judicial decisions appearing in the books, not with any degree of particularity confining the decision to any one instance, but maintaining a general rule which can be applied in all cases.

There is, in New York State, no extra license required, where a dentist branches out and begins to specialize in a particular phase of dentistry. Once he has his license, and, by virtue of his experience, aptitude, and application, he confines his efforts to a particular phase of dentistry, then you have the specialist. The exodontist specializes in the removal of teeth; the oral surgeon specializes in the surgery of the mouth, and yourselves, namely, orthodontists, deal with the correction of the arches and teeth alignment.

So, once licensed, the law then places upon the dentist certain duties with respect to his patients, and this placing of duties on the dentist is not a unilateral situation; it is bilateral in a sense that corresponding duties and obligations are placed legally upon the patient, although they certainly are not as extensive or far-reaching as the duties and obligations placed on the professional man.

As indicated before, the dentist is not allowed to remain static or retrogress. There are many publications of educational value to the dentist, which he is required to read in order to keep abreast of the times. Sometimes in the professional man's office you will see these books, and from all indications they remain untouched from the time of receipt. That certainly does not indicate the progress required. He is expected to be familiar with new medications, new instrumentalities, and new theories of practice dealing with his profession. Furthermore, your societies, of which you are a member, provide means of keeping up with professional progress. There are your meetings at clinics by which men of experience and renown come and deliver lectures. It is not expected that the dentist attend every single meeting in every single clinic, but, generally speaking, he is required to keep up with the progress of his profession, to a substantial degree. How else can a man know the new and different practices and procedures and relegate to the background the ones that have become obsolete?

Besides the meetings at clinics, there are postgraduate courses given, both by societies and hospitals, and these are given by men with special training in their particular field, and they are certainly in a good position to administer the changes they advocate, and also specifically express the reasons for their acceptance. All of these attentions are particularly important to the individual specializing in a particular phase of his profession. They certainly and unequivocally add to his qualifications.

The general rule that says that the professional man must indulge in the accepted methods of practice seems simple enough. It is the interpretation and application of that rule that provides difficulty. The accepted methods of practice mean in brief the procedures that are generally followed by individuals in the same field of practice, and under the same or similar situa-

tion, in the same or similar location. Uniformly throughout the states the general rule is as just stated. However, the circumstances of each individual case are important, because even a slight change of the circumstances may cause an accompanying change in the procedure to be followed. The neighborhood where the patient presents himself is important in determining the accepted practice. Surely, what procedure is indicated and accepted in New York City, where every facility is available, would not be the same as the accepted practice in some small town located a great distance from New York, where the facilities and appurtenances necessarily are limited, and the practitioner in that small town would correspondingly be called upon to use only those facilities and appurtenances that were found, or expected to be found, in that particular area. Another important factor in determining the accepted practice is the status of the practitioner. Usually, in order to determine the type of procedure to be indulged in, it must be decided whether the treatment is being rendered by a general practitioner, or by one specializing in a particular field.

The dentist, and more particularly in your case, the orthodontist, like any other professional man, is never by law expected to guarantee a good result. This is the general rule and allows of only one exception, which is most unusual and generally unheard of, and that is an instance in which a specific contract is made which contains a guarantee of a good result. The corollary of the last observation is that the mere fact that a poor or bad result follows orthodontic intervention does not, in and of itself, give rise to liability for a malpractice lawsuit. If it was held otherwise, a serious situation would be created. It would place an impossible burden upon the practitioner, and so we would be reluctant and hesitant, and even refuse to undertake cases in which a doubtful result might be foreseen. The effect, as you can see, would not confine itself to the individual patient, but would be so extensive as to affect the entire practice.

Another result would be that the progress of the profession would not only be retarded, but also the improvement that has been so sensational for the past thirty years would be negligible. A poor result in order to be compensable from a point of view of malpractice liability must be brought about by contraindicated technique. The best example I can think of at this time is the use of various instruments and the occasional fracturing thereof. The dentist, in purchasing instruments, goes to the most reliable distribution house, which may, in turn, purchase instruments from one of the best known manufacturers, but, because of some unforeseen, unexpected, and unknown flaw in the metal itself, the instrument might fracture. To hold the orthodontist responsible for injury resulting therefrom would certainly be unfair and harmful. Frequently, complications set in postoperatively which are not, have not, and could not be foreseen in advance. A particular example of such an instance may be where neither clinically nor radiographically the examination revealed the onset of osteomyelitis, and the dentist, following the extraction of a tooth, finds later on that the net result, because of trauma to the area, is a fulminating osteomyelitis. This can be classified as an unforeseen complication for which the dentist should not be held, and the law does not so hold him.

There are many other instances where poor results follow or injuries are sustained after treatment, which are traced to the conduct of the patient, and, where such conduct is contraindicated, the patient then is held to be guilty of what is known as contributory negligence. Contributory negligence, although a technical expression, merely means that the patient himself, or herself, by negligent conduct has contributed to bring about a result that is harmful. Under such circumstances, the law says that the patient is not entitled, legally, to recover. You can conceive of an example where a patient, following the extraction of a tooth, uses some unsterile means of picking at the area of the socket, contrary to the dentist's instructions at the time the patient is leaving his office. Such a procedure would establish a competent cause of introducing foreign substances, unquestionably unsterile, in the area where sterility is important. Such a procedure would likewise be the cause of traumatizing tissue that is making a serious effort at normal regeneration, and possibly create vestibules, as entranceways to infection, and infection flared up in a particular area, certainly, where, following such conduct on the part of the patient, infection resulted, the practitioner could not be held, and is not held, responsible.

There is another point that comes to my mind at this time and that is the question of the abandonment or relinquishing of a patient by the practitioner while the patient is under treatment. It is true that no professional man, in the absence of an emergency, is called upon to render treatment to any particular patient. He is completely free to take on, or refuse, treatment of any patient. I mention "except in an emergency" because, while there is no legal rule to treat a patient in an emergency, the generally recognized ethics seem to indicate that emergency treatment, where required, should be given, but after the rendition of the emergency treatment no further treatment is to be given by the practitioner. However, once the practitioner has undertaken to treat a patient, there rests upon him a duty not to withdraw from the case under certain conditions, and these are legal requirements.

These conditions differ in various jurisdictions, but might be substantially described as follows: Where a dentist by his treatment has created a condition in the patient's mouth that requires further treatment, he cannot refuse to render that further treatment, unless and until he has seen to it that equally competent dental attention is available. But, if he does refuse to continue and a poor result ensues, he is legally responsible for the damage sustained by the patient.

There is a difference in the jurisdictions, because the First Department, which is Manhattan and the Bronx, merely says that the dentist must make available someone equally competent. The Second Department, which comprises Brooklyn, Westchester, Staten Island, Nassau, and Suffolk, goes even a little further and says that the dentist must see to it that the patient is placed in the hands and actually under the treatment of someone equally as competent.

This situation frequently arises where the fault is completely that of the patient, where the patient refuses to cooperate and this lack of cooperation is not only disheartening but also destructive of the work that has been done.

I am sure that you, as orthodontists, frequently run into situations where patients, after making agreements with respect to treatment and payment, reach a point where, finally, they cannot continue the contract. The inability of the patient to pay, in and of itself, is not sufficient justification to relinquish the treatment of the patient. This does not mean that the dentist must go on to any extensive trouble and expense in further treating a patient, where he knows further compensation to him for his work is not forthcoming.

Frequently, professional men run into the question of whether or not consent was given for a particular procedure. This question never really becomes important in hospitals, because patients are required to sign a consent stipulation. But, in the professional man's office, it does, at times, become important. Generally speaking, consent is a condition precedent to the rendition of any dental treatment, with one exception, and that exception is in the case of an emergency where consent cannot be obtained immediately, and under the circumstances to wait for such consent might prove too late for any assistance. However, once the emergency has passed, the requirement of consent with respect to further treatment is necessary. You, frequently, must be asked by whom consent can be given. In the case of adults, it is simple. The adult submitting to treatment gives consent and it does not have to be a specific consent. Conduct frequently spells that out. Just as in the consent that is particularly given concerning a particular tooth extraction, consent is not given specifically for every particular step, such as swabbing the area, injecting the area, cutting postoperatively to remove spiculae of the alveolar processes, nor to sew up the wound. In the original consent there is an implied consent for all collateral procedures. It should not be understood that consent, such as to extract one tooth, is extensive enough to include the extraction of another.

The situation is different in the hospital where the patient is under a general anesthetic, and during the operation certain conditions are exposed that are deemed important to attend to. That consent is coextensive with the reasonable interference with other conditions that evidence themselves.

In the case of infants, of course, the consent becomes a little more difficult, and this equally applies in the case of incompetents. Neither can sensibly consent to the performance of dental work generally. Consent of a parent or guardian is necessary in order to authorize the performance of treatment. Of course no rule seems to have been made where there are not exceptions, and here, again, we find that to have been the case.

Infants are classified as those under 21 years, and there is, in the law, the rule of emancipation, which means that some children under 21 are not legally bound by family ties and have been freed from parental control and supervision, and such individuals, even though they are infants, may give their own consent.

The general rule which applies to most cases reads as follows:

> The law relating to mal-practice is simple and well settled, although not always easy of application. An orthodontist by taking charge

of a case impliedly represents that he possesses, and the law places upon him the duty of possessing that reasonable degree of learning and skill that is ordinarily possessed by an orthodontist in the locality where he practices, and which is ordinarily regarded by those conversant with the employment as necessary to qualify him to engage in the business of practicing orthodontia. Upon consent to treat a patient it becomes his duty to use reasonable care and diligence in the exercise of his skill and the application of his learning to accomplish the purpose for which he was employed. He is under the further obligation to use his best judgment in exercising his skill and applying his knowledge. The law holds him liable for an injury to his patient resulting from want of the requisite knowledge or skill or the omission to exercise reasonable care or failure to use his best judgment. The rule in relation to learning and skill does not require the orthodontist to possess extraordinary learning and skill, which belong to only a few men of rare endow, but such as is possessed by the average member of the orthodontic field of the dental profession in good standing. Still he is bound to keep abreast of the times, and departure from approved methods in general use, if it injures the patient, will render him liable, however good his intentions may have been. The rule of reasonable care and diligence does not require the exercise of the highest possible degree of care and to render an orthodontist liable, it is not enough that there has been a less degree of care than some other orthodontist might have shown, or less than even he himself might have bestowed, but there must be the want of ordinary and reasonable care leading to a bad result. This includes not only diagnosis and treatment, but also to give proper instructions to his patient in relation to conduct, exercise and use of the area interfered with. The rule requiring him to use best judgment does not hold him liable for mere error of judgment, provided he does what he thinks is best after careful examination. His implied engagement with the patient does not guarantee a good result, but he promises by implication to use the skill and learning of the average orthodontist, to exercise reasonable care and to exert his best judgment in an effort to bring about a good result.

The orthodontist has his matter placed before twelve jurors who are to determine whether he indulged in the proper practice or not.

You can readily see, because of the newness of orthodontics, the general inexperience of the public in having it done, the time required, the price entailed, and the application on children, that jurors might not afford much sympathy to the defendant orthodontist. In fact, I think jurors today are a much more serious problem than they used to be. Years ago, in the selection of a jury, they were more or less catalogued as bellicose, lacrimose, comitose, verbose, jocose, humorous, and morose. Today, the category is completely different. Today they are physiological, psychological, pathological, biological, sociological, chronological, illogical, and logical.

There is only one sure, positive, unequivocal means for an orthodontist to avoid a malpractice lawsuit and that is to give up the practice of orthodontics.

TREATMENT OF A CLASS II, DIVISION 2 CASE IN WHICH THE REDUCTION OF TOOTH MATERIAL WAS INDICATED

Report of a Case

Howard W. Peterson, D.D.S., Steubenville, Ohio

THE patient, a white boy, 11 years, 10 months of age, presented for treatment in August, 1948.

Impressions for record casts, full-mouth intraoral radiographs, full-face and profile photographs were taken at the first appointment.

Active treatment was started in October.

History.—The patient was in good health and normally developed for his age. Mental development was considered superior. Measles, chicken pox, and mumps had been contracted at an early age. Adenoids and tonsils had been removed at 3 years of age. First deciduous teeth erupted at 5 months, and exfoliation of these teeth began at 5½ years. As an infant he had been bottle-fed.

General health conditions had been good with the exception of a slight sinus condition that was experienced at infrequent intervals. There was no record of early habits that might have been related to the development of the malocclusion and none were discernible at the time of examination.

The father, a general dental practitioner, had a mild Class I malocclusion, and the mother very closely approached a normal dentition.

Etiology was considered to be obscure and probably developmental in origin.

Case Analysis.—From a study of the record casts, radiographs, and photographs, and subsequent examination of the patient, the following case analysis findings were listed:

1. The lower buccal teeth were mesially inclined on both right and left sides, creating an exaggerated curve of Spee, causing the left lateral incisor to be locked lingually; the other lower incisors were slightly forward to base and slightly migrated to the left of the midline. The entire lower dentition was forward in relation to cranial anatomy and mandibular base.
2. The upper dentition presented a Class II relationship to the lower; the incisors presented only slight labial inclination but were in extreme supraclusion. There was a slight overlapping of the central incisors.
3. *General considerations:* There was an extremely deep overbite and the lower dental arch was quite constricted due to the size and shape of the supporting bony structure of the mandible. Lower third molars were impacted. The Frankfort-mandibular plane angle was 31 degrees.

Read before the Annual Meeting of the Northeastern Society of Orthodontists, Hotel Commodore, New York, N. Y., March 3, 1952.

The preceding analysis led me to classify the case as Class II, Division 2 (Angle). Treatment time was estimated at approximately two years.

The objectives of treatment were:

1. To place the teeth of both dental arches in as nearly normal relationship to their supporting bony foundations as possible.
2. To correct the Class II cuspal relationship of the teeth and improve their functional balance and appearance.
3. Attempt to reduce the amount of overbite present.
4. To reduce the fullness in the lip areas of the face with the correction of maxillary incisor position.

Treatment Outline:—In order to reduce the Class II cuspal relationship of the dentures and also to bring tooth material into balance with available supporting bone structure it was decided to remove the four first premolar teeth.

The edgewise arch mechanism was the appliance of choice. The plan of treatment procedure followed the principles advocated by Dr. Harry Bull for the correction of Class II conditions, and was as follows:

1. Remove the mandibular first premolars and move the cuspids of this arch distally a sufficient amount to permit alignment of the incisors in upright relationship to basal bone.
2. Maintain the maxillary second premolars and first and second molars in their original position without forward drift.
3. After alignment of the six mandibular anterior teeth, move the second premolars and molars, both right and left, forward into the space provided by the first premolar extractions. This will bring about the correction of the Class II molar relationship.
4. Move the maxillary cuspids distally into the spaces provided by the first premolar extractions in this arch to bring these teeth into normal cusp relationship with the cuspids of the mandibular arch.
5. Carry the maxillary incisors lingually to normal relationship with the mandibular incisors.
6. Complete final detailed tooth positioning and retain as indicated.

Treatment Procedure.—A bite plate was constructed and placed in the maxillary arch. The mandibular first premolars were removed. All teeth in the mandibular arch were banded excepting the left lateral incisor which was locked lingually. The cuspids, second premolars, and incisors were banded with edgewise bracket bands. The molars were banded with 0.006 inch chrome steel band material. The first molars bore two edgewise brackets and the terminal second molars one-fourth inch rectangular buccal tubes.

All bracket bands except the first molars had mesial and distal staples for necessary rotations.

Upon completion of band fitting and cementation a series of resilient steel arch wires were placed in the mandibular arch, namely, 0.016 inch, 0.018 inch, 0.022 inch round and 0.021 by 0.025 inch rectangular, effecting a gradual leveling off and uprighting of the teeth in the buccal areas.

When the leveling off process had been completed 0.021 by 0.025 inch steel sectional arches were prepared for each buccal segment of the mandibular arch (Fig. 1).

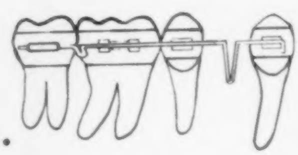
These extended from second molar to cuspid, a Bull closed loop was incorporated in each arch wire to fall into the extraction space midway between the cuspid and second premolar teeth. A small tieback loop was also bent into this arch to fall in the embrasure between the first and second molars. This loop when tied back to the second molar activated the Bull loop which was the force employed to carry the cuspids distally.

These arches were tied in and activated at three-week intervals by opening the spring loops approximately 1 mm. at each activation.

This procedure was continued until the cuspids had been moved distally a sufficient amount to permit the alignment of the incisors over basal bone.

The left lateral incisor was then banded and with a series of resilient steel arch wires up to 0.022 inch round and finally an 0.021 by 0.025 inch rectangular all of the incisors were brought into alignment. The bite showed considerable opening at this time (seven months, April, 1949). The bite plate was now discarded.

1.



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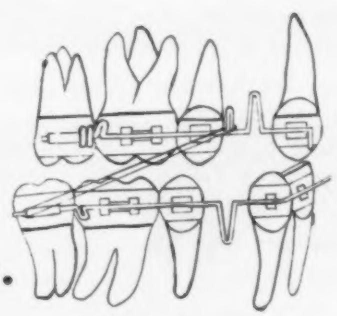

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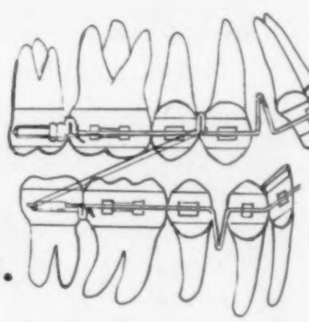

Figs. 1, 2, and 3.

The maxillary canines, second premolars, and first and second molars were banded in the same manner as in the mandibular arch, the second molars again serving as the terminal teeth and bearing rectangular buccal tubes.

A series of arch wires 0.018 to 0.022 inch round were tied into the maxillary buccal teeth to level off and to gain bracket control. When leveling off had been completed the maxillary first premolars were removed.

Sectional arches of 0.021 by 0.025 inch steel were now fabricated for the maxillary buccal segments. These differed somewhat from the sectional arches used previously in the lower arch.

They had three loops incorporated in them (Fig. 2).

The first and most anterior loop was a Bull closed loop falling distal to the cuspid in the extraction space, for the purpose of moving the cuspid distally when activated. Just distal to this loop was a smaller closed loop which served as attachment for the anterior ends of the Class II elastics. The third and most distal loop was a small loop used as a tieback or traction spur loop; this fell in the space between the distal bracket of the first molar and the mesial

surface of the second molar buccal tube, and was placed as far forward from the tube as possible. On the section of arch wire between the molar tube and the tieback loop one-sixteenth inch washers cut from molar tubing were placed. Before seating these sectional arches, the last washer on each arch was removed; this left a space one-sixteenth inch between the most distal washer and the molar tube. When the arch was activated and tied back this permitted the opening of the activating loop one-sixteenth inch only and closed the space completely between the last washer and the molar tube.

At this same time a full 0.021 by 0.025 inch chrome steel arch wire was placed in the mandibular arch. In it were incorporated Bull closed loops, which fell directly distal to the cuspids, and tieback loops about one-fourth inch mesial to the buccal tubes on the second molars.

This lower appliance was seated and the six anterior teeth tied in as a stabilized unit, the loops were activated on each side about one-sixteenth inch or slightly more, and Class II mechanics instigated.

This appliance set up as explained was the suggestion of Dr. William G. Houghton, of Watertown, N. Y., and the action was as follows:

1. The mandibular incisors and canines were stabilized.
2. The mandibular buccal teeth were being moved forward by spring loop action and Class II elastic force.
3. The maxillary buccal teeth were being prevented from any forward movement by the Class II mechanics.
4. The maxillary canines were being moved distally by the action of the Bull closed loops.

The loops of both appliances were activated at three-week intervals until the maxillary extraction spaces were closed. Edgewise bracket bands were then fitted to the four maxillary incisor teeth and with a series of resilient arch wires brought into bracket engagement. Class II mechanics were discontinued during this period.

When leveling off was completed a new 0.021 by 0.025 inch double loop arch wire was constructed for the maxillary arch (Fig. 3). The activating loops in this arch wire were placed mesial to the cuspids, however, for retraction of the incisor teeth. Loops for Class II elastics were incorporated in the arch wire distal to the cuspids and tieback loops in the same approximate location as in the previously used sectional arches. The washers were used in the same manner as before.

Since the spaces in the mandibular arch had not been completely closed the arch wire in this arch was not changed at this time, but the use of the double loop arch was continued.

The loops in both appliances were again activated, Class II elastics again started, and adjustments made as before. When spaces were closed in the mandibular arch Class I molar relationship had been established.

A full 0.022 by 0.028 inch stabilizing arch wire was now constructed for the lower arch with tip back bends incorporated in the buccal areas. Class II

Fig. 4.

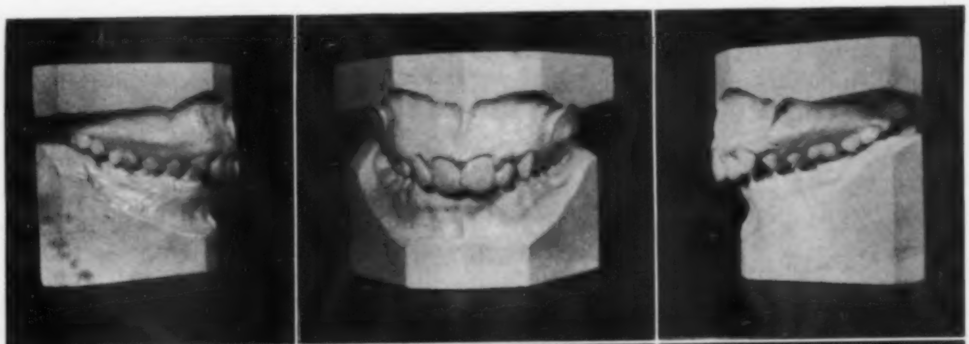

Fig. 5.

Fig. 6.

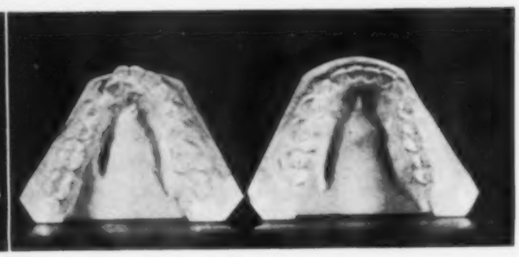

Fig. 7.

Fig. 8.

mechanics were continued in conjunction with loop activation of the maxillary appliance until retraction of the maxillary incisors was completed. An ideal 0.021 by 0.025 inch edgewise arch was then placed in the upper arch and detailed tooth positioning completed.

The maxillary bands were removed first with the exception of the second molars and second premolars and a plain 0.022 inch round arch wire was kept cinched back in this arch for a period of several weeks. During this time the mandibular appliance was removed and a cuspid-to-cuspid soldered lingual retainer placed. No retention was used in the maxillary arch.

Active treatment was completed in January, 1951, and record casts were constructed at that time. The lower retainer was removed in July, 1951, at which time final x-rays and photographs were taken. Treatment time consumed twenty-seven months.

These records show the completed results. Fig. 4 shows the front and lateral aspects before treatment. Fig. 5 shows the front and lateral aspects after completion of treatment. Figs. 6 and 7 show the upper and lower occlusal aspects at beginning and conclusion of treatment. Fig. 8 shows profile photographs at beginning and conclusion of treatment.

An examination of the case within the past week shows no undesirable changes since completion of treatment and radiographs of all third molar areas show these teeth in the process of normal eruption.

510 Sinclair Bldg.

OBJECTIVES AND TREATMENT IN THE MIXED DENTITION

Harlow L. Shehan, D.D.S., Jackson, Mich., and
Edward A. Cheney, D.D.S., M.S., Lansing, Mich.

It is a privilege to discuss some of the interesting problems which arise during the mixed dentition. There are, during this stage of development, a great many opportunities to guide growth and intercept malocclusion. The problems of this period challenge the orthodontist to understand and recognize the dentofacial needs of the growing child. It is a period where treatment must be concise and often is dramatic. It is a period when we can direct the developmental potentialities of the individual, but, also, it is a period when the integrity of the practitioner is open to judgment. Whereas, in the early adult dentition he can draw conclusions based on clinical evaluations alone, here the orthodontist must also include the factor of growth and must know that the dentition has had its chance of expression before modification is initiated.

There are numerous developmental changes which take place during the mixed dentition. Many of these are expected. Just prior to the beginning of the transition from primary to permanent dentition, the face, jaws, and teeth present a most interesting combination. The face is small in proportion to the other parts of the skull. The jaws are but buccal and lingual plates. Between them lie the partially and fully developed crowns and roots of the primary and permanent teeth. At this time there are more teeth present than at any other time in the life span. Twenty primary and twenty-eight permanent dental units are closely grouped and intricately spaced. They stand poised for one of the the most complicated and exciting developmental "sprees" of the human body, the transition stage of dental development.

Broadbent graphically demonstrated the development which takes place during the mixed dentition. He carefully pointed out the flexibility which attends these changes. He demonstrated the high degree of integration between the teeth and the jaws as they work together to produce the adult dental unit. In addition, he illustrated that all is not beautiful during the changing sequences of the mixed dentition.

It is not our intention to review the sequences of dentofacial growth during the transition stage. Anyone who considers mixed dentition treatment must be well versed in the developmental changes of this period. Rather, we wish to emphasize that the growing dentition has a great potentiality to express itself to the fullest extent. Treatment procedures during the transition stage should not be initiated until full recognition of these potentialities has been given. Often the individual's ability to develop is such that correction of undesirable relation-

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From the Department of Orthodontics, University of Michigan.

ships will occur as growth takes over in its orderly form. We have no license to step in and treat where the developing dentition has the potentiality to overcome irregularities of its own volition.

For example, consider the problem of lower crowding during the early mixed dentition. Often, much to the concern of the parents and dentists, the permanent incisors erupt lingual to the lower primary incisors and are crowded. As illustrated in Fig. 1, irregularities of this type often straighten out as growth proceeds. In this illustration there are six consecutive views of lower casts taken of the same individual one year apart. In Fig. 1, *A* and *B* the permanent central incisors have erupted to the lingual and have moved forward. In Fig. 1, *C* and *D* the permanent lateral incisors have erupted lingually to their primary predecessors. This is to be expected, since they also develop in this relationship. Here, even though the primary lateral incisors were not extracted, they shortly exfoliated and in one year the permanent successors moved into position. The same course of development was followed by the canines in Fig. 1, *E* and *F*.

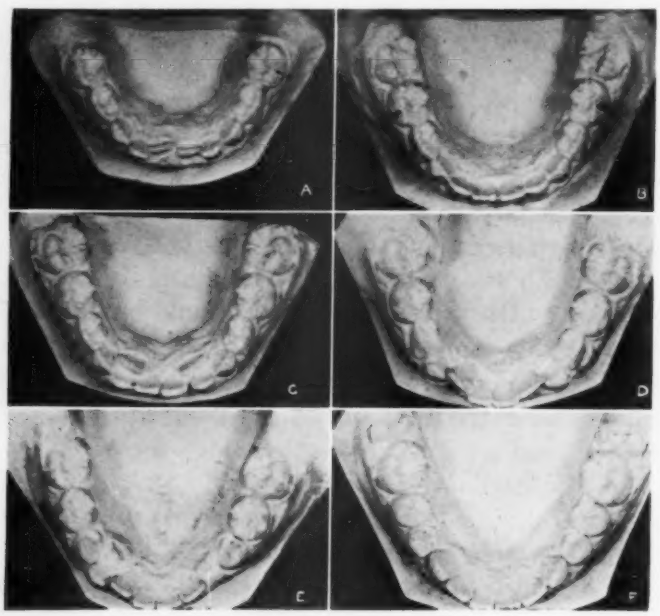

Fig. 1.

There are many growth sequences similar to the one just illustrated that are typical of normal growth changes which take place during the mixed dentition. The spacing and closing of maxillary central and lateral incisors, the slow ramblings of maxillary canines, and the shifting of premolars are others. There is no doubt that many of these changes do not coordinate as well as the one just illustrated. Yet in no case can any of them be termed abnormal or requiring treatment until sufficient observational data indicate that the sequence is out of order.

The extraordinary ability of the developing dentition to unravel many of its own idiosyncrasies is even more dramatically illustrated in Fig. 2. Here are the records taken of an untreated case over three successive years. The upper

cast reveals the presence of a maxillary canine locked in x-bite. The middle cast shows the occlusal changes incident to the transition from primary to permanent teeth. In addition the canine is changing position. The lower cast reveals that the canine has moved of its own free will. It has changed from its lingually locked position to its now correct position. This it did by itself. Ordinarily we would not expect this change. Yet this case does confirm the fact that the power of the growing dentition to help itself is exceptional. Any consideration of treatment during the mixed dentition must take account of this fact and be planned to accommodate it.

There are, however, a considerable number of developmental irregularities occurring during the mixed dentition. These warrant consideration. In our opinion, the modification of these irregularities constitutes treatment objectives, inasmuch as the removal of them not only results in a corrected relationship, but also in a change which contributes in a large proportion to a satisfactory and functional adult dentofacial complex. There is no doubt that the significance attending the presence of developmental irregularities in the mixed dentition varies from one individual to another. Yet many of those which appear most simple are often of greatest importance. We would like to review a number of conditions which in our opinion constitute developmental irregularities and discuss methods for dealing with them.

Fig. 2.

One of the most disturbing developmental irregularities which occur in the mixed dentition is the cross-bite. Cross-bites occur commonly in the anterior and posterior dentition and may involve single or several teeth at one time. They are objectionable because: (1) they may act to destroy teeth and supporting structures, (2) they may result in maldistribution of supporting alveolar bone, and (3) they may cause obvious and objectionable facial asymmetries. There are many methods of dealing with undesirable cross-bites in the developing dentition. As we have previously indicated it is our opinion that these methods must be sufficiently flexible to fit the changes and adaptation which take place within the dentition during the process of growth. In any case the appliance should be simple within the limits of simplicity permitted by the individual situation. There are several appliances which meet these requirements and which are well adapted for dealing with anterior cross-bites. One is the inclined plane. The tongue blade is a device particularly useful in correcting cross-bite relationships of central and lateral incisors. Under ideal conditions bilateral inlockings

may be dealt with by means of the tongue blade. Usually, however, this technique is most effective when applied to cross-bites involving only one tooth in either arch.

The application of the tongue blade technique is illustrated in Fig. 3. This illustration shows a left central incisor locked lingual to its opponents. All other teeth are fairly well aligned. The patient is instructed to catch only the tip end of the blade under the incisor edge of the tooth. This relationship is shown in the upper right exposure. Often it is necessary to use narrow blades in order to avoid contact with adjacent teeth. Wide blades may be split in half for this purpose. During exercise the patient is asked to draw the blade back hard against his chin, as illustrated, always keeping the tongue blade parallel to the long axis of the tooth to be moved. The tongue blade then provides a steep inclined plane which directs the tooth labially. There is little or no intrusive force acting to depress the tooth. This consideration of intrusion is of particular importance in cases where the depth of bite is shallow. Here a small amount of intrusive action can reduce the retentive advantage of an overbite relationship of the incisor teeth and contribute to a relapse following the end of treatment.

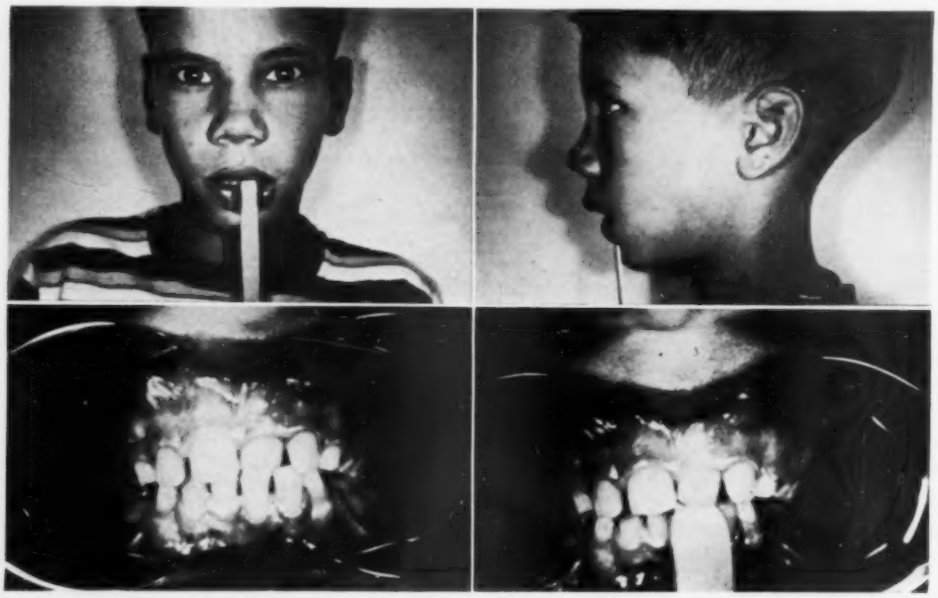

Fig. 3.

There are many methods of exercising with the tongue blade in an effort to "jump" a lingually locked central or lateral incisor into correct position. Whatever procedure is used, it is best to be very specific when giving instructions to the patient. One successful set of instructions advises the patient to bite hard upon the plane for five counts, relax for three counts, and engage in this exercise to the extent of fifty contractions and relaxations of the jaws and musculature before each meal and before retiring. During the exercise the patient should main-

tain a continuous biting contact with the tongue blade. A good way to explain this aspect of treatment is to advise him "never to take his teeth apart." This confines treatment to the area under consideration.

The exercise before each meal is of particular advantage. It enables the mother to supervise the tongue blade activity at regular periods. After a few days of hard exercise, the patient will find that he can bite with the teeth in an edge-to-edge relationship and can usually establish a slight amount of overbite. At this stage of treatment the mastication of food with the teeth in their correct relationship is of great value. It provides an acceptable reason for continuing the exercise and sets up the first stage of the retentive phase of treatment. Once the patient can attain an overbite relationship, he should realize that the responsibility of maintaining this change is entirely his. *This fact must be thoroughly emphasized* at the beginning of treatment. In most cases a conscious effort on the part of the patient to maintain the correction will bring the treatment to a successful end in a surprisingly short period of time. The treatment with the tongue blade illustrates the principles of the inclined plane.

The Hawley incline, the interdental ligation technique, and the plastic and metal inclines cemented to the lower incisors may also be used. We wish to point out that the tongue blade and similar appliances enable us to deal simply with minor growth problems at this stage of development.

As we resort to these methods, however, we must give important consideration to patient cooperation. A consideration of patient cooperation is of major importance in the use of the simpler preventive and palliative appliances. Like the tongue blade many of these devices are not fixed in nature. Accordingly, the success with the use of them is greatly dependent upon the patient's willingness to work as directed. It is up to the operator then to solicit the upmost in cooperation if he is to achieve the desired end in treatment procedures. In most cases, the solicitation of patient cooperation is neither difficult nor time-consuming. A majority of children respond graciously once they understand the nature of the problem and the reason for making the correction. Even so, however, the approach to treatment cannot be lackadaisical. You cannot just "toss" the tongue blade or any other appliance at a patient and expect results. Each individual must thoroughly realize the limitations and abilities of the appliance of choice and know exactly what his responsibility in treatment should be. Failure on the part of the operator to present this information and failure of the patient to understand it lead to a mutual lack of confidence and add nothing to the luster and prestige of orthodontics. On the other hand, the successful use of simple treatment devices calls for an effort which challenges the best in the practitioner to gain full cooperation of the individual patient and demonstrates to the public a real understanding of the interesting biology of denotofacial development.

Posterior x-bites are most objectionable when they result in facial asymmetries. The mere malposition of the posterior teeth themselves is not always objectionable. Usually, the relationship is not esthetically undesirable and the occlusion can be ground to rule out traumatic interference. On the other hand, in the mixed dentition there may be other implications. For example, when the

maxillary dental arch is constricted the free-moving mandible cannot adapt to the functional centric occlusion. For this reason the patient learns to shift the jaw laterally to accommodate occlusion during mastication. The shift creates a facial asymmetry in the form of a lateral displacement. The end result is a posterior cross-bite. Treatment in these cases calls for widening of the maxillary dental arch until the mandibular dental arch can occlude in the usual midline functional centric relationship.

It seems important, again, to emphasize the extent to which treatment must be carried in the mixed dentition. At this stage dentofacial development is far from complete. It is only beginning to show in its final form. The modification of dental structures during this stage, then, cannot always be considered an end in itself. Treatment need be only those procedures necessary to give direction and guidance to the growing structures toward desirable relationships in the permanent dentition. Once the correct direction of growth is established, active treatment should be discontinued. The case, however, should continue to be observed until the dentition is erupted and the dentofacial relationships are well established. In the interception of cross-bite, then, as in all other preventive orthodontic procedures in the mixed dentition, a minimum of treatment is indicated for the guidance of growth.

The removal of habits when they interfere with dental development is another objective of mixed dentition treatment. There is much discussion about the influence of oral habits upon the developing dentition. We do not wish to enter into these controversies at this time. It is sufficient to point out that for some children engaging in oral habits no undesirable results will take place. In others the most unexpected changes will occur. In our analysis and approach to these problems, then, we are obligated to look at the individual in order to determine what his problem is and what it means to him. When we note that habits are interfering with the growing structures we can determine the significance of these structures and act accordingly. In some cases it is advisable to interrupt the activity. In others it will be more appropriate to let well enough alone.

The most effective approach to oral habit control is the psychological one. Habits are an integral part of every life and we hope only to replace undesirable habits with useful habits which, from our point of view, do not disturb the developing dentition. This objective can be accomplished in a number of ways. Most effective, but not necessarily easy, is the direct appeal to the patient himself. Results obtained by this approach are illustrated in Fig. 4. The cast on the left shows the extent of the irregularity. This patient is 8½ years old. She had a neutroclusion with an obvious open-bite. A persistent finger-sucking habit prevented the incisors from erupting. The mother had not been able to cope with the habit.

Before considering the significance of the habit with the child, the mother was asked to leave the operating room. The child was shown a set of casts demonstrating that continued finger-sucking had created an unsightly irregularity. She was also allowed to examine the models of an ideal or normal occlusion. By her own examination she was able to see the implication of finger-sucking.

In this case the child appeared willing to try. She was further instructed to work the problem out with her doctor and without the help of her mother and father.

The idea of "working the problem out with her doctor" requires also that the orthodontist gives cooperation. In this case the doctor talked with the patient every two weeks on the telephone. He showed a continuing interest in the patient's progress. Results were forthcoming. The right cast shows the change after six months' effort on the part of the patient to stop her finger habit. Apparently, the interest of an important outside member of the family was effective in soliciting cooperation in this child. The child stopped the habit. As the casts show, the results were gratifying.

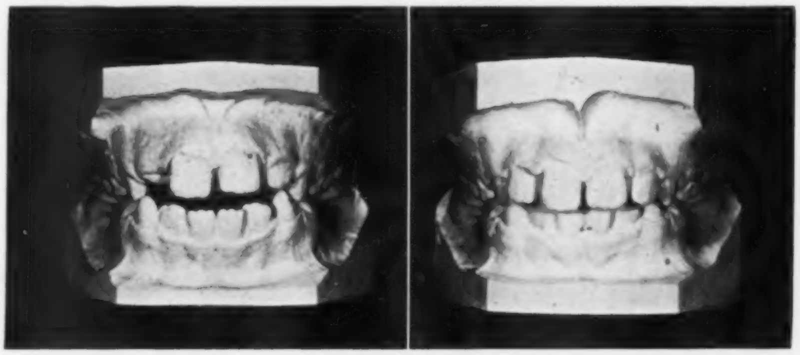

Fig. 4.

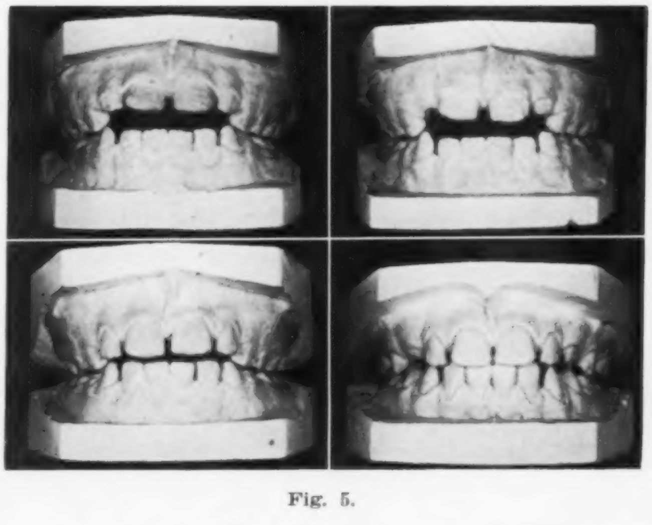

Fig. 5.

Now obviously not all children will respond to the direct appeal. Many do not seem to be able to motivate themselves along these lines. These children are often aided by "reminder devices" which serve to help them to remain aware of the habit activity. The young girl whose casts are shown in Fig. 5 needed this sort of assistance. These casts show a Class I open-bite with maxillary incisors in marked infraversion. Originally the patient had been a thumb-sucker. After

stopping this activity, at her mother's insistence, she changed to a habit of rolling the upper portion of the tongue against the lingual surface of the maxillary incisors. Here, again, the nature and significance of the habit were explained to the patient. She was asked to put her tongue in the "bottom" of her mouth and was directly appealed to for cooperation every few weeks. However, as shown by the upper right cast no changes occurred. The patient admitted that she could not remember. With her permission we placed the reminder device shown in the center exposure. It is a plain lingual wire with short spurs soldered lingual to the maxillary incisors. For a few days the patient's tongue was highly irritated. However, she agreed to wear the device longer, as she explained to "teach her tongue a lesson." After the initial placement the patient wore this device for six months. The cast taken at that time is shown on the lower left and reveals great improvement. The appliance was removed and records taken six months later, lower right, indicate a return to her normal developmental plan.

Some children interfere with the development of their dentitions by placing fingers or blankets between their teeth during sleep. These cases are difficult to manage. Sometimes we can use lip seals to prevent the placement of offending objects in the mouth during the night. Scotch tape is one material which can be used as a lip seal. The vermilion borders of the lips are brought tightly together and are sealed together with long strips of tape which crisscross over the mouth from the infraorbital area to beneath the chin. In other cases we wish to retrude incisors which have been modified by lip or finger habit. If the incisors protrude the use of an oral shield along with the lip seals is very effective. The oral shield is made of gutta-percha or Plexiglas and is made to fit the oral vestibule. The patient's lips are brought tightly together and sealed shut over the shield. The pressure of the appliance against the incisors, during sleep, usually retrudes these teeth to a desired position. In addition, in the case of lip habits, the continuous stretching of the lips serves to increase the lip tonus and function. This activity is highly beneficial to dental development.

In the late stages of the mixed dentition we often see patients who have marked dentofacial deformities from viscous oral habits. These cases call for corrective efforts as well as habit control. They are among the most difficult to manage and often the damage is too extensive to overcome completely. Here treatment is not at all standardized. Moreover, considerations of this nature are geared to modifications typical of early adult dentition treatment. Accordingly we do not wish to consider the management of these problems. Rather we would stress that the control of undesirable oral habits is a *most important early mixed dentition treatment objective.* When indicated, there is no finer service which we can offer to a child.

During the mixed dentition much attention must also be given to the problems of space management. There are a great number of these cases. Basically they are problems of timing. Sometimes nature appears to confuse the rates of resorption, exfoliation, and eruption. In those situations the orthodontist has an opportunity to manage the exchange of dentitions to the best interest of the patient. The too long retention of primary teeth is one

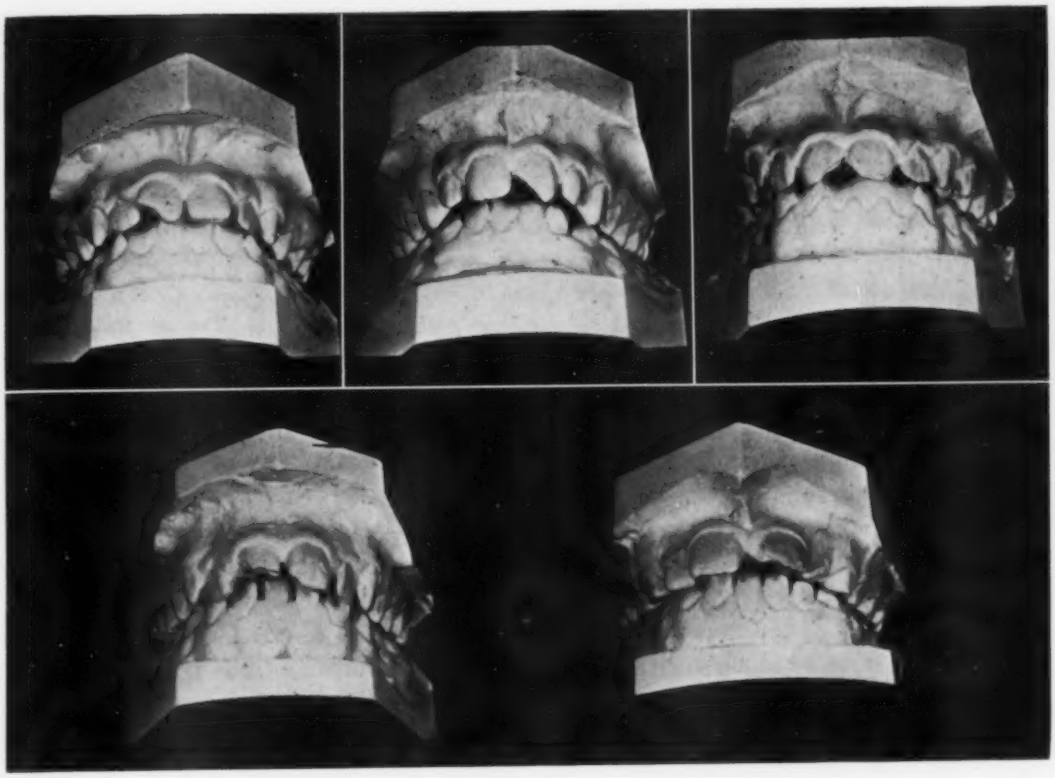

Fig. 6.

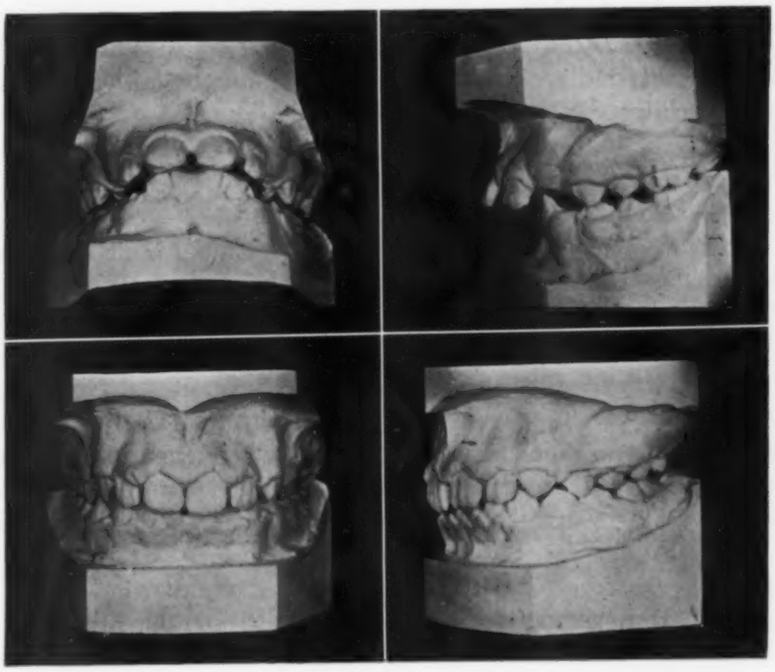

Fig. 7.

example of these problems. As is commonly known, too long retention of primary incisors results in lingual eruption of permanent incisors. Often they grow into cross-bite relationships. The too long retention of primary molars, similarly, can result in the deflection of premolars buccally or lingually. Sometimes the primary molars occupy too much space and the premolars are forced mesially or distally. If they happen to lock, intercuspally, in occlusion they hold these positions and cause the adjacent teeth to erupt into malposition. It is unfortunate that manay of these cases are not under supervision when the developmental crises peculiar to them arise. Often the timely removal of primary teeth and the judicious disking of the marginal ridges of primary molars serve to straighten out a disorderly growth sequence.

A great number of problems arise, also, with the early loss of primary and permanent teeth during the transition stages of the mixed dentition. Again treatment procedures considered in these situations must be conceived with full awareness of the growth potentialities of the individual. Close observation serves to determine these possibilities. Often, the careful collection of observational data will give us the key to the type of management needed. Many times on the basis of facts taken from the individual we learn that the use of space maintainers or minor dental adjustments is not needed, or should be delayed until a later time. Indeed, *it seems to us that in far too many cases the mass application of space maintenance has superseded a study of the needs of the individual.*

There is one other treatment objective which we would like to consider at this time. We refer to those Class II, Division 1 malocclusions in which there is extreme protrusion of the maxillary anterior teeth.

In discussing the extreme protrusions, we wish to differentiate it from those protrusions resulting from oral habits. Although habits are often associated with Class II malocclusions, the protrusion in these cases is as often a disfigurement resulting from a dentofacial dysharmony as from the habit itself. Basically treatment is initiated in order to retrude the maxillary incisors. It is not habit control.

There are several reasons why we advocate the correction of extreme Class II, Division 1 protrusions as early as possible. Initially, we wish to avoid fractures to the maxillary incisors. These teeth in their protruded state are exceptionally vulnerable to any blow which is aimed in their direction. All of us have seen cases of fractured incisors. A series of these results are shown in Fig. 6. Due to accidents in play, in automobile encounters, in falling down steps, and numerous other circumstances, these and many other incisors are deformed. We have had the sad experience of advising against early treatment in these cases and then examining the patient several years later when he would return with a fractured tooth. These were unhappy occasions both for us and for the parents. Accordingly, we now advocate the treatment of all extreme protrusions in order to remove these teeth from the obvious path of trauma during the period of the mixed dentition.

These extreme protrusions are also highly undesirable from an esthetic and psychological point of view. Orthodontics is a service primarily devoted

to the highly important responsibility of human facial appearance. The betterment of facial form is indicated at any time when it is undesirable to the patient. Many children become extremely sensitive about their teeth during the mixed dentition. The protruding incisors are often called "buck teeth" and the child is "chided" by his playmates.

Numerous cases of personality conflicts, poor schoolwork, lack of interest in playing with other children, and general resentfulness are directly associated with extreme protrusions. As shown in Fig. 7 the reduction of incisor prominence greatly enhances both the appearance and function of the developing mixed dentition. Also, as demonstrated by comparing the before and after side views in this case, there can be great advantage to the general dentofacial growth by the early correction of this distoclusion. This consideration is not a part of our discussion. However, we would like to point out that in our experience, corrections of this nature have been permanent and stable in numerous cases. Moreover, they have resulted from shorter periods of active treatment than would have been anticipated for a similar attempt in the young permanent dentition.

It has also been our experience that facial form benefits from early correction of the extreme Class II, Division 1 protrusion cases. Both by inherited inclination and by lack of function, the upper and lower lips are ineffective in stimulating dental development and in providing appearance. The upper lip stays short and curls above the protruded incisors. The lower lip is depressed, thickened, and becomes flabby beneath protruded crowns.

The retrusion of the incisors and the enabling of lip contact and closure are a worth-while contribution to dental development and facial appearance. When these changes are initiated and instigated under reasonable circumstances, they become worth-while orthodontic treatment objectives during the period of the mixed dentition.

In conclusion, there are many objectives and treatment procedures which warrant consideration in a discussion about the mixed dentition. It is our belief that these considerations should be kept to a minimum. In the mixed dentition the pattern of development, although fixed in nature, is incomplete. In general, comprehensive treatment initiated during this stage of development is not self-sustaining and is often undesirable. Many times the retentive stage of treatment is drawn out and is difficult to manage. Often the treatment becomes long and burdensome, and the financial load heavy for the family. Accordingly, except when the nature of the dentofacial complex indicates such procedure, we advocate minimum treatment efforts. For this reason our discussion has emphasized simple and short-term treatment. We advocate only those procedures necessary to guide the developing dentition and to promote its health and welfare.

FACTORS ASSOCIATED WITH SUCCESSFUL ORTHODONTIC TREATMENT

Robert H. W. Strang, M.D., D.D.S., Bridgeport, Conn.

In approaching a subject as broad as the one covered by this title, it is quite necessary that the essayist confine himself to the basic facts and avoid details wherever possible, in order that a reasonable time be consumed in delivery.

What then constitutes a successful result in orthodontic treatment? My answer is, "One in which the objectives of treatment are attained and subsequently remain stabilized thereafter for an unlimited number of years."

In discussing the objectives of treatment, it is my conviction, after years of clinical experience, that we can no longer use the phrase normal occlusion as an all-inclusive objective in the treatment of malocclusion. To attain this ideal it is essential that all structures, intraoral and environmental, shall be normal. Such perfection of parts is not to be found in cases of malocclusion or malocclusion would not be present. Furthermore, there are very few cases of malocclusion in which the operator, no matter how skillful, can bring back to perfection the various parts that are contributory factors in the production of malocclusion.

Consequently, the objectives of treatment must, by careful analysis of each individual case, be rationalized and coordinated with the limitations of mechanical and therapeutic corrective measures.

However, knowledge of limitations must never tend to lower our ideals. The objectives of treatment in all cases must aim to give a result that will exhibit as many of the characteristics of ideal normal occlusion as the abnormal factors and structures will permit. The great danger of compromise is its tendency to lower idealism and one must constantly fight against such an influence.

However, to attain stability in the final result, one must frequently resort to treatment procedures that produce a denture that lacks many of the characteristics of the ideal. In the past, far too little study has been devoted to conditions that are of prime importance in stabilizing the products of orthodontic treatment. Yet lack of permanency in the results of years of effort in treatment by the operator and, coincidentally, associated with the expenditure of large sums of money by the payee, have brought more criticism and skepticism upon our specialty than any one other factor. Certain it is that treatment cannot be considered as successful unless the quality of stabilization is associated with its results.

Consequently it is this long-range view of orthodontic treatment that I desire to bring to your attention at this time.

Presented at the Twenty-second Annual Meeting of the Great Lakes Society of Orthodontists, Cleveland, Ohio, Nov. 7, 1951.

I am sure that you will agree with me when I state that to map out the objectives in treatment of each individual case for the purpose of approaching as closely as possible to the ideal, and coincidentally not overlooking the restrictions placed upon corrective procedures by the factors that are essential for a permanent result, demands the most painstaking preliminary study of the patient, of a detailed history, of the plaster casts, photographs, radiograms, both intraoral and oriented head films, and sometimes carpal roentgenograms.

Such a study takes time and because of this no operator should overload his practice to such an extent as to be unable to find time to make this essential analysis. There is a limitation to the number of new patients that an orthodontist can accept each year if he is to do justice to each individual case. Consequently, avoiding overloading one's practice is the first factor to observe in successful treatment.

The important facts that are derived from this initial analysis cannot be kept in mind but must be recorded in written form. Therefore when treatment is to begin, the orthodontist should have compiled complete written records of the entire course of treatment. These records should include a detailed history, the radiographic findings, the objectives of treatment, the appliance assemblage, and, most practical of all, the step-by-step manipulation of the appliance whereby the objectives of treatment may be attained.

Such combined data have been quite routinely applied in determining the objectives in treatment. Yet coordinating these same data with factors that are influential in maintaining stability in the product of treatment has been given little if any consideration in the past. It is for this reason that failures have been so much in evidence.

For years and years we aimed at ideal normal occlusion as an end result, paying no attention to the fact that we were not dealing with structures that had the potentiality of normal in their make-up. We held to the belief that we could make them normal by mechanical manipulation followed by natural function. Even enlightened by research findings, many of us plodded on in the old way, expanding undergrown dentures or moving buccal segments backward, in an effort to make a normal out of an abnormal aggregate. Then we resorted to mechanical retention for years and finally upon turning these structures free from this mechanical restraint, watched them disintegrate to a greater or lesser degree.

Fortunately, within the last few years, principally through the courage and ability of one man, Charles H. Tweed, we have been made conscious and ashamed of our high percentage of failures. We have begun to study the cause of these failures and to plan our objectives in treatment with a careful consideration of permanency.

Tweed centered his attention on basal bone, believing that if the teeth were moved to positions where they were perfectly supported by their osseous foundations, stability would be attained. At first he attempted to avoid the reduction of dental units and gain his objective by excessive expansion in the molar, premolar, and canine areas, combined with a posterior movement of all the teeth. This permitted a coincidental flattening of the incisor segment of

the dental arch whereby a lingual movement of the teeth in this area was effected. By this combination of tooth movements these anterior teeth were repositioned "on the ridge," as Tweed called it.

However, he soon found that he was impacting the posteriorly located second and third molar teeth and also that the expansion obtained by this procedure was gradually reduced, subsequent to the removal of the retaining devices, and the malocclusion in the anterior teeth recurred to an undesirable degree.

He then resorted to extraction and less expansion and obtained far greater stability. I was fortunate enough to fall under the guiding genius of Tweed about ten years ago and carefully followed his technique from that time on. Stability in results immediately jumped to a marked degree under the plan of extraction and moderate expansion. However, there were still some failures, notably in relapses in the incisor area of the mandibular denture, where it was still customary to expand in order to get the incisors back to the basal position.

About six years ago, I began a more intense study of this problem of stability which, I felt, was not solved by the one procedure of placing the teeth on basal bone. I began to analyze the before and after models of the cases I had treated that had remained stable and also those that had collapsed after retainers were removed. In taking measurements on these various sets of models I was amazed to find that invariably the width across the mandibular canine teeth was identical in the model of the original malocclusion and in the model of the same case which had remained stabilized subsequent to removal of the retaining fixtures. I also found these measurements were identical in the cases that had collapsed after treatment.

This led me to the conclusion that there was an inherent muscular balance active on the dentures of each individual and this was a fixed portion of the anatomical make-up and must be taken into consideration in planning the objectives of treatment. In other words, muscular balance in a denture could not be violated in treatment.

The thought then followed that if this was so and if treatment procedures did not violate this axiom, could mechanical retention be dispensed with? Certainly the idea was worth trying because, if collapse began to appear, mechanical retention could always be resorted to.

In carrying out this plan, the measurement across the mandibular canines in the model of malocclusion was used as the guide rule. A pattern of arch wire form was devised that would produce arch wires that would hold this measurement inviolate in the majority of cases. However, to be still further certain that the arch form was correct, it was tested always on the model of malocclusion before being placed in the mouth.

In order rigidly to adhere to this rule it was, of course, necessary to extract teeth in many more dentures than was previously essential. This was demanded in order that space would be available to correct overlapping and rotated dental units and also to place the incisor teeth in positions overlying their basal bone, for I attempted to still follow the dictates of Tweed in this portion of treatment.

However, if it was found that even by extraction sufficient space was not available to place the incisors entirely back on their basal bone without expansion across the canine areas of the dentures, I did not expand but accepted as favorable a position on basal bone for the incisors as could be obtained without the expansion.

When the mandibular canines were moved distally into the spaces created by the extraction of the first premolars, buccal movement of the canines was then permissible. Note that the words buccal movement are used and not expansion. This is so stated because the first premolar teeth occupy a position farther buccally than do the canines. Muscular balance also dictates the buccolingual location of these teeth. Therefore, the canine teeth can be placed farther buccally if moved into the premolar areas without violating the influence of muscular balance.

This rule of nonexpansion then became the primary objective in the treatment of these test cases for the production of stability. Other important objectives will be mentioned later. At the end of treatment all appliances were removed. In a few of these cases it was found by measurement that, even with the greatest of care, the canines had been expanded. These, however, became just as important and interesting to observe as did those in which the objective was actually attained.

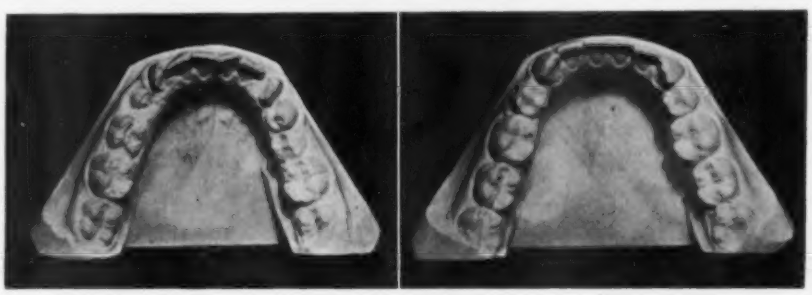

Fig. 1.—Stability in mandibular incisor area. Model on right taken four years after active treatment. No retaining appliances were used.

The results of this test were so convincing that this procedure has now become routine in practice. In the past five years I have placed but four mandibular retainers on my completed cases. Measurement after measurement has been taken in the mandibular canine areas and the correlation between the original model and the case after a year or more of freedom from active appliances is positive.

I do not mean to imply that in all of these cases the mandibular incisors have remained in perfect alignment. There have been cases in which too much tooth material would have been sacrificed by extraction and in which, on the other hand, not sufficient distal movement of the buccal teeth could be gained by treatment without extraction. This meant that not sufficient incisor area was obtained by the minor degree of canine movement toward the wider premolar area. In these cases there has been a partial relapse in the mandibular incisor area. But this was predicted before treatment and an-

nounced to the parents at the time the corrective work was begun. I am certain that if these cases had been retained for years, the result would have been the same when the mechanical restraint was discontinued.

In extraction cases, where sufficient space was available to obtain denture area in the incisor region by the distal movement of the canine teeth without expansion, the mandibular incisors remained well stabilized without retention for years succeeding active treatment.

Therefore, I am firmly convinced that the "axiom of the mandibular canine width," which may be stated as follows, "The width, as measured across from one canine to the other in the mandibular denture, is an accurate index to the muscular balance inherent to the individual and dictates the limit of denture expansion in this area in treatment,"* is the most important objective to maintain in treatment if one is to gain stability in the finished result.

What, then, are some of the other objectives which must be considered in their relationship to the ideal and to stability?

1. The elimination of etiological factors. This is an objective which, in far too many cases, it is impossible to attain. The primary causes of malocclusion lie hidden in the mysterious processes of growth and development and evolve modifications in the pattern of one or more bones of the face or cranium. These etiological factors are beyond our power to control. It is these factors that dictate compromise. Many secondary causes, with which you are all familiar, can be overcome or reduced in their effectiveness.

2. Placing the teeth in such positions that they will have substantial basal support. I am thoroughly sold on the value of this objective which Dr. Tweed advocated and follow this principle to the extent permitted without expansion.

3. Obtaining correct inclined plane adjustment. In both nonextraction cases and extraction cases the producing of intimate meshing of inclined planes in the finished product of active treatment is an essential detail. True it is that a few patients can best be treated by sacrificing premolar teeth in one denture only. This, of course, prohibits the occlusion of certain planes that should normally be in contact. However, the compromise adjustment necessitated by such a situation is sufficiently intimate to produce stability if muscular balance is not violated.

4. The establishing of an axial position of each dental unit that either is normal or is purposely modified to resist best any stress force that tends to produce a recurrence of the malocclusion.

This indicates that corrective procedure must take into consideration the position of the roots of the teeth in relation to their crowns. Consequently the operator must have the means at his command to produce root movement as well as crown movement if this objective is to be gained.

5. Obtaining correct proximal contacting of every tooth. This demands the proper rotation of those teeth requiring such treatment. It is my opinion that teeth that require rotation should be overrotated in the correction pro-

*Strang, R. H. W.: Text Book of Orthodontia, ed. 3, Philadelphia, 1951, Lea & Febiger, p. 514.

cedure. While the fibers of the periodontal membranes are not elastic structures, yet they are interlaced in such manner that considerable tooth movement can be made before they are strained to the point where their ends will be freed from cementum and bone by osteoclastic action. If they are not stretched sufficiently to produce this osteoclastic action, they will exert a relapsing force upon the tooth when mechanical force is discontinued. Hence a tooth that is rotated only sufficiently to produce a perfect correction will tend to return to the previously rotated condition to a minor degree, but sufficient to upset the desired proximal contacting which is so important for stabilization.

6. Securing an overcorrection of excessive overbite. I am frank to admit that there are certain types of overbites that up to the present date I have been unable successfully to overcome permanently. In most of these, it is not a problem of treatment but one of retention. These are cases in which vertical growth in the oral area of the face is distinctly lacking. The treatment indicated is elevation of the buccal teeth. The use of a bite plate and vertical elastics will effect successful treatment but far too often a relapse occurs when mechanical retention is discontinued, for I use mechanical retention in the form of a bite plate in these cases. The prognosis is unfavorable in such cases and must be presented to parents as such before corrective work is begun. On the other hand, in those cases in which vertical growth in the oral area has progressed sufficiently to have produced harmony in the facial lines before treatment is begun, yet an excessive overbite is one of the symptoms of the malocclusion, this symptom can be permanently eliminated by appliance manipulation. However, as in the rotation of teeth, overcorrection is an important detail to adhere to. Furthermore no retention is essential in such cases.

7. Obtaining balance and harmony in the activating and environmental tissues. These, quite frequently, are the most baffling and also the most important conditions to obtain if a successful result is forthcoming.

Habits, involving abnormal muscular activity, are extremely difficult to eliminate even in the most cooperative of patients. Whether or not the protrusive positions of the anterior teeth are irritating factors in the formation of some of these habits, I do not know. I do know, however, that in many of these cases in which, subsequent to extraction, the incisor teeth have been moved lingually, the habit factor has been markedly improved. This is particularly true in the case of swallowing habits attended by hyperaction of the mentales muscles.

The effect of hypotonicity can be reduced by building up muscular strength through proper exercises. Hypertonicity, on the other hand, must be looked upon as a fixed condition. Its effect on the denture can be analyzed by studying the malocclusion. A typical case molded into malocclusion by this etiological factor exhibits a somewhat narrowed denture with the buccal segments of both arches shifted forward at the expense of denture space for the canine teeth.

Only by the compromise of extraction can such cases be successfully treated if permanent stability is to be included in the objectives of correction.

To push the incisor teeth forward against these boardlike muscles, in order to obtain space for the canines, is courting certain failure for this strong muscular pressure will eventually force them back, no matter how long a period of retention is resorted to.

8. Finally resorting to occlusal equilibration. After the dentures have settled, subsequent to the removal of the active appliances, the presence of excessive points of contact will tend to destroy the possibility of permanent stability. This fact has only recently been emphasized in orthodontic literature but we are bound to hear more and more of its important bearing upon permanency of tooth positioning and the health of the tooth-supporting structures.

It has been quite a universal procedure, in orthodontic practice, to view our results only in positions of centric occlusion. Cuspal contacting in various adjustments associated with functional occlusion has been rarely tested. If this is done routinely we will be astonished to see how few of our cases exhibit balanced occlusion.

Most of us are prone to complete our cases with the canine teeth in marked supraclusion. This was emphasized by Dr. Cecil Steiner several years ago. Consequently, when the mandible is moved laterally, as it always is in functional activity, these supracluding canines offer obstructing barriers to this movement. This frequently results in a lingual displacement of the mandibular canines which then impinge on the incisor area of the denture and produce a displacement of the mandibular incisor teeth. This displacement of the canine teeth is undoubtedly Nature's method of relieving a state of exaggerated traumatic occlusion.

Minor degrees of traumatic occlusion are much more insidious and, in the period of years following orthodontic treatment, often produce far more deleterious effects than that of a recurrence of malaligned teeth. This destructive influence upon tooth stability is exhibited by degeneration of the tissues of tooth support, i.e., the periodontal membrane and the alveolar process. All of us are very familiar with the gingivally displaced gum and bone attachment of a mandibular incisor that is labially displaced by the crowding of its approximal associates. This is a clear illustration of traumatic occlusion. Traumatic cuspal adjustment in the buccal teeth, even to a minor degree, is capable of producing a similar effect, but it is not discovered until years later when the teeth loosen and a radiogram is taken to ascertain the cause. Consequently, testing of each completed case with carbon paper, combined with various functional movements of the mandible, seems very advisable. This should not be dône until the case has settled with intimate occlusal adjustment subsequent to the removal of the active appliances.

The proper spot grinding of these points of excessive occlusal contact to eliminate such a condition, however, is a delicate procedure and certainly should not be undertaken before special training in this technique has been acquired. It is a scientific procedure and attempting it without proper knowledge of the correct method of performing the operation is very likely to result in more harm than good. Hence cases requiring such treatment should be referred to a competent specialist in periodontia.

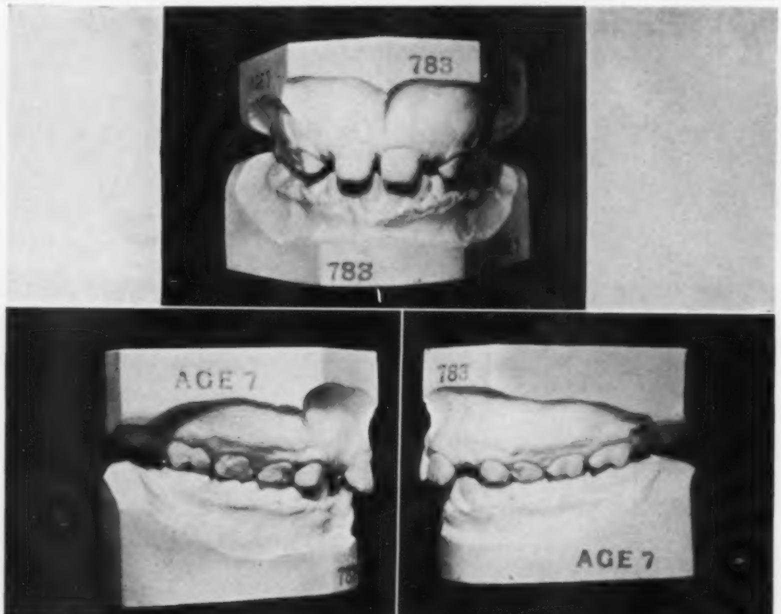

Fig. 2, *A*.

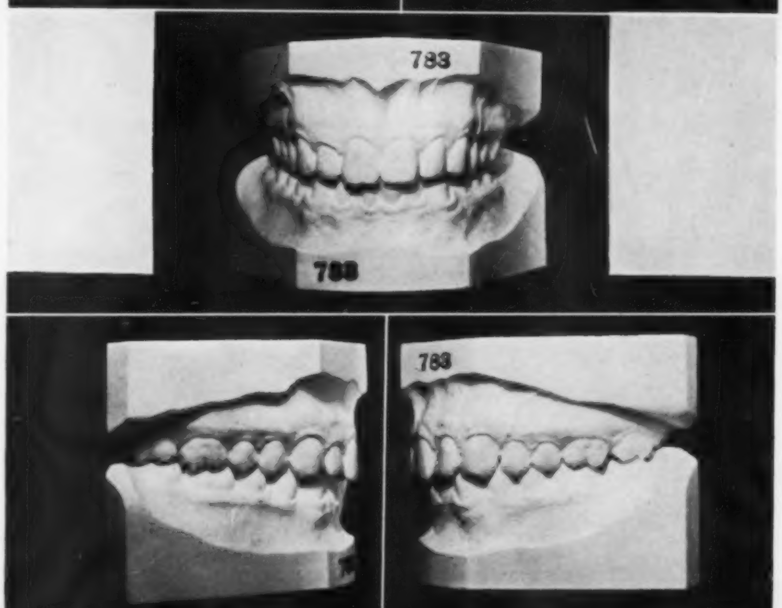

Fig. 2, *B*.

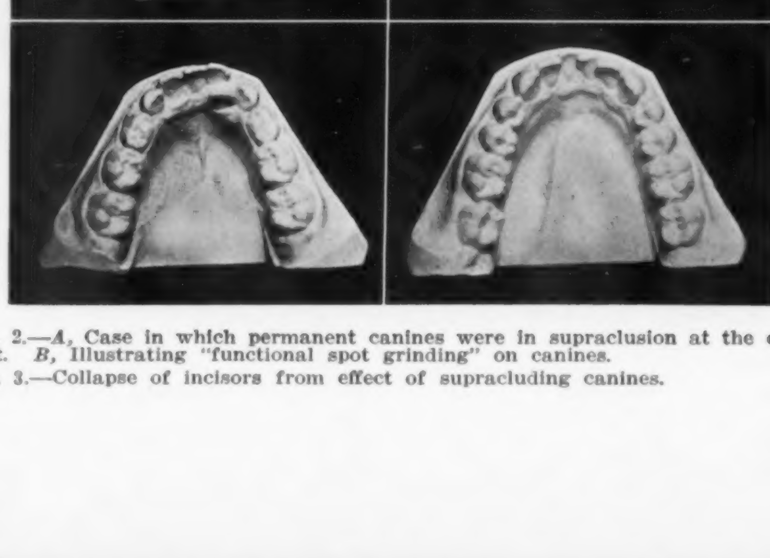

Fig. 3.

Fig. 2.—*A*, Case in which permanent canines were in supraclusion at the end of active treatment. *B*, Illustrating "functional spot grinding" on canines.

Fig. 3.—Collapse of incisors from effect of supracluding canines.

Fig. 4.

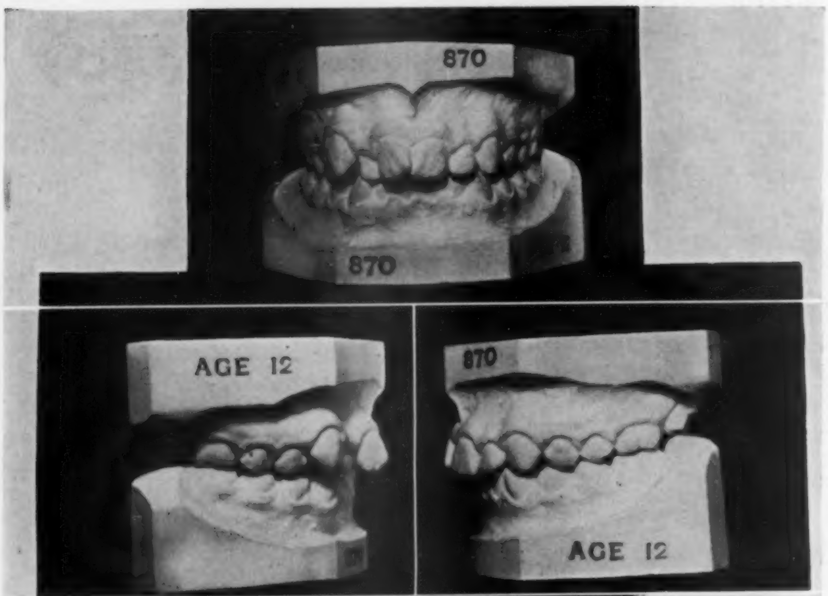

Fig. 5.

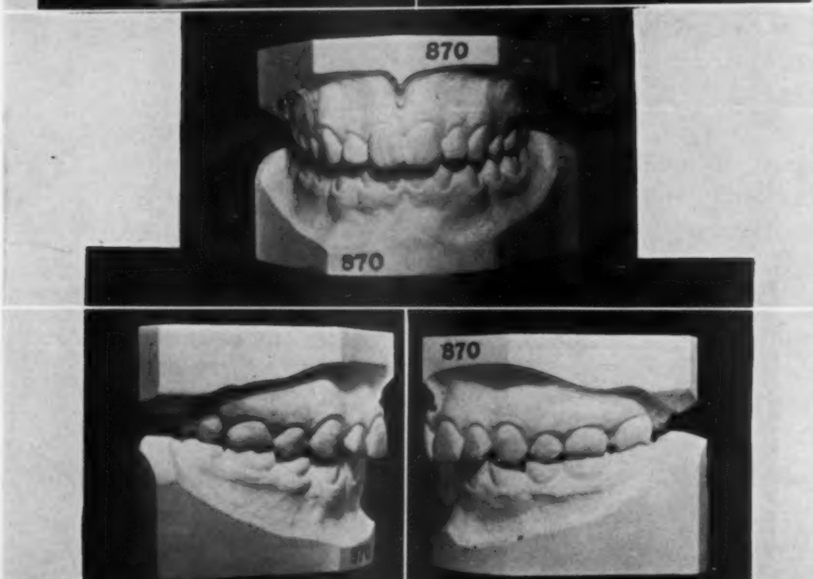

Fig. 6.

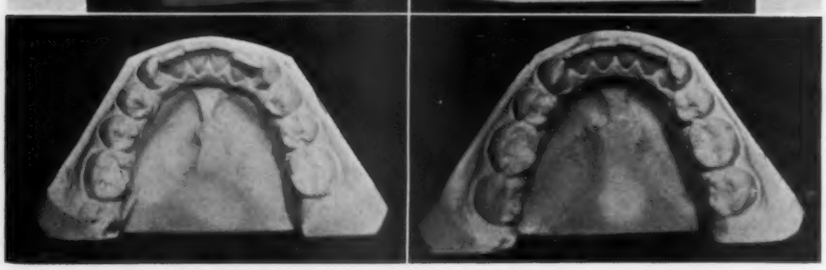

Fig. 4.—Test case in which no retaining appliances were used.

Fig. 5.—Models of case in Fig. 4 taken four years after active treatment. No retaining appliances were used.

Fig. 6.—Mandibular models of case shown in Figs. 4 and 5.

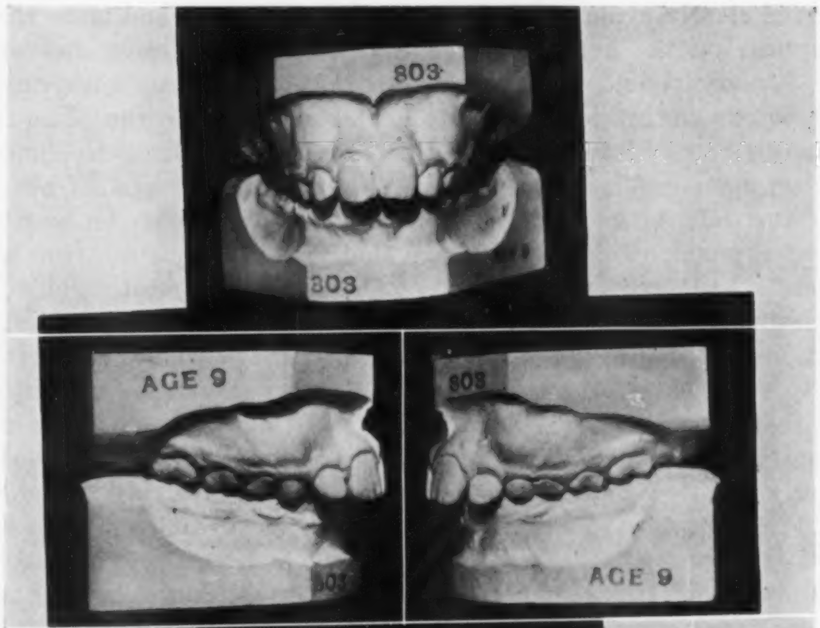

Fig. 7.

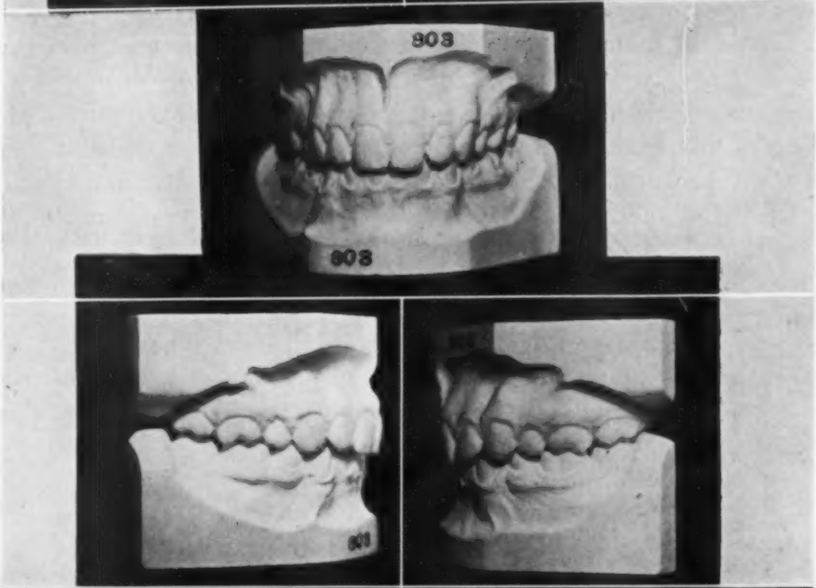

Fig. 8.

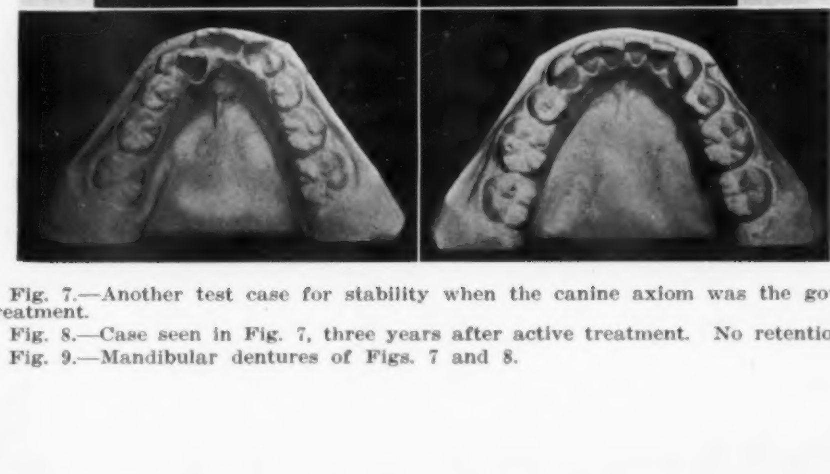

Fig. 9.

Fig. 7.—Another test case for stability when the canine axiom was the governing rule in treatment.

Fig. 8.—Case seen in Fig. 7, three years after active treatment. No retention appliance.

Fig. 9.—Mandibular dentures of Figs. 7 and 8.

Thus, it is clearly evident that as time passes on, more and more clinical problems appear on the horizon to tax the patience and endurance of the operator in our special field of endeavor. Yet the conscientious worker cannot side-step these responsibilities if he is to do justice to those who place themselves under his care. The long-range view of a healthy, efficiently functionating denture, well stabilized for years after orthodontic treatment has been completed, must now be accepted as the standard of appraisal for successful orthodontic treatment. This is a standard that preserves idealism from every viewpoint and, if adhered to, will elevate orthodontics to a most dignified and respected position in the minds of the laity, an objective well worth striving for.

In bringing this paper to a close, I really feel that I should apologize for its simplicity and lack of original material. My only excuse for presenting it is the fact that I am purely a clinical orthodontist and as such I have noted that the contents of orthodontic papers during the past few years have been predominantly devoted to research material. This speaks well for the advancement of our profession along scientific lines, and great credit and honor should go to the men who have spent hours and hours of time in gathering this basic knowledge. It has resulted in definitely establishing the truth where guesswork was previously in evidence. This is particularly applicable to the processes involved in facial growth and development. Furthermore, this research material has provided the clinician with a far more intelligent conception of treatment problems. Case analysis can be approached with a clearer understanding of the basic factors involved in corrective procedures. Hence a more accurate prognosis can be rendered because difinite limitations are recognized. Yet the fact remains that the correction of malocclusion is the one excuse for the existence of our specialty.

Hence it is my hope that a paper emphasizing thoroughness of procedure, in combination with definite, predetermined objectives in treatment, will serve to stimulate a renewed interest in clinical practices. This is essential if the practical phase of orthodontics is to keep pace with the great advancement being made in the scientific branch of the specialty. As we gain in basic knowledge, so may we advance in clinical skill.

886 Main St.

In Memoriam

JAMES D. LOCKE

1877-1952

JAMES D. LOCKE, a pioneer orthodontist who was one of the first to practice in the state of Michigan, and who practiced in Grand Rapids for more than fifty years, passed away Saturday, July 12, 1952. He slept in his summer home on the west shore of Elk Lake near Williamsburg.

Dr. Locke was 75 years old and had been in failing health for a year or more, though he had continued his practice to a limited degree, as his health permitted. He was born in St. Thomas, Ontario, Canada, and grew up and had his early schooling there. He graduated from the University of Chicago Dental School and on graduation went at once to Grand Rapids and began his practice.

Dr. Locke was a past-president of the Great Lakes Society of Orthodontists, life member of the American Dental Association, a past-president of the Michigan Dental Society and of the E. S. Holmes Dental Society, now the Kent County Dental Society. He was a life member of Delta Sigma Delta, dental fraternity. He was a member of the Rotary Club, a former member of the Peninsular Club, and a life member of York Lodge, F&AM.

Dr. Locke is survived by two sons, James and John, both of Grand Rapids, two sisters, Mrs. R. B. McGregor of Hamilton, Ontario, Canada, and Mrs. William Leonard of Port Stanley, Ontario, Canada, and three grandsons.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

A Discussion on the Significance of Growth Changes in Facial Pattern and Their Relationship to Changes in Occlusion (read at the Fiftieth Annual Meeting of the European Orthodontic Society): By Professor Arne Björk, D. Odont. Copenhagen. Reprinted in part (with permission) from *The Dental Record,* November, 1951.

"The purpose of the investigation is to clarify some problems connected with the development of the bite and its relation to facial growth in the individual.

"The investigation includes X-ray exposures of the facial profiles of a group of boys who had previously been examined at the age of 12 and who are now being re-examined at the age of 20. This follow-up study covers 150 individuals at present, but it is estimated that the total number of cases examined will reach about 250 this year [1951].

"The results of an earlier cross-sectional investigation of the facial structure (Björk 1947) based on cephalometric X-rays of these 12 year old boys and an approximately equal number of adult males, altogether 603 cases, had indicated that the facial structure is subject to considerable growth changes in pattern during adolescence, a condition which is also reflected in the growth taking place in the occlusion of the bite.

". . . the growth changes in the facial skeleton have been measured on lateral X-ray films of the head, and in this way it has been possible to form an opinion of the change in form and size of the various parts of the facial skeleton during the growth period 12 to 20 years. . . .

"The three basic elements which determine the general shape of the cranium are the brain case, the cranial base and the facial skeleton, each one having its own distinct growth and development. By referring the growth analysis to a reference plane through the cranial base it has been considered possible to adapt the method of measurement from the lateral X-ray exposures so that it conforms as closely as possible to the nature of the growth process of the entire head (Figs. 1 and 2).

"As the primary aim is to illustrate growth changes in the prognathism of both jaws, the contructed facial diagrams . . . are compared from the reference plane through the cranial base, drawn through nasion and the centre of sella turcica, taking nasion as the starting point. The protrusion of the upper and lower jaws in relation to the cranial base is expressed by angles of prognathism, measured from the cranial base to four different points on the facial profile (1—4), as will be seen from Fig. 2. The growth changes in these angles of prognathism are marked in degrees . . . opposite the appropriate points on the profile. The facial pattern as a whole is shown on a diagram as a line enclosing the facial skeleton, see Fig. 1. The magnitude of the cranial base angle or the saddle angle, which in the diagram is formed by two lines passing through the anterior and posterior parts of the cranial base (5), provides a measure of the shape or deflection of the cranial base. The angle formed by the cranial base and ramus, the joint angle (6), expresses the inclination of the ramus forwards or rearwards. This angle is characteristic in so far as the shape of the mandible is considered in relation to the shape of the skull as a whole. The other angles

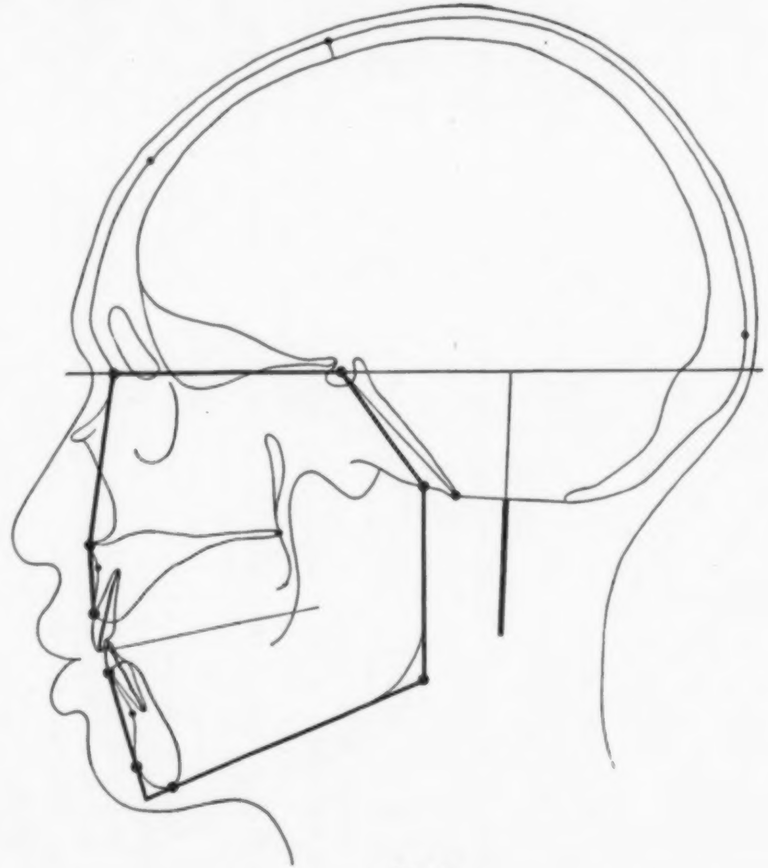

Fig. 1.

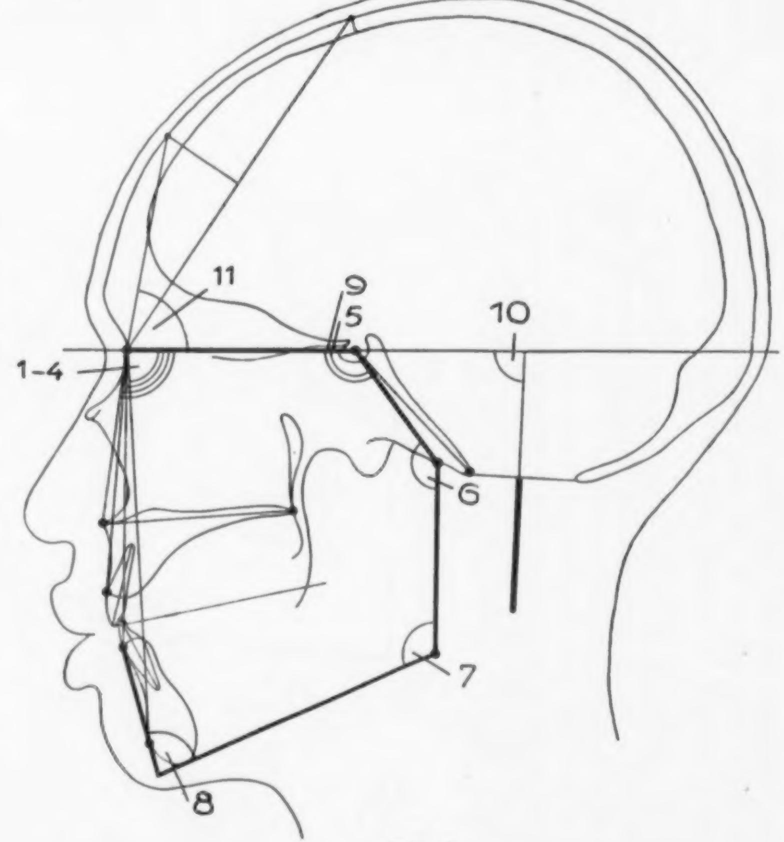

Fig. 2.

Fig. 1.—Facial diagram for measuring variations in the facial structure and the cranial base, from a lateral x-ray exposure.

Fig. 2.—Diagram indicating the method of measuring the angles of prognathism (*1-4*), the shape of the cranial base (*5-9*), the inclination of ramus (*6*), the jaw (*7*) and chin (*8*) angles, the inclination of the forehead (*11*), and the position of the foramen magnum (*10*), from a lateral x-ray exposure.

in the facial diagram are the jaw angle (7), and the chin angle (8). Growth changes in these four angles in the diagram, the saddle angle, the joint angle, the jaw angle and the chin angle, are also marked in degrees on the following diagrams.

". . . The shape of the cranial base is also denoted by the angle nasion—sella—basion (9), i.e. to the anterior ridge of foramen magnum. The balance of the head is denoted by a line normal to foramen magnum, and is given by the angle formed by this line with the cranial base plane (10). The slope of the forehead is expressed by an angle measured to the cranial base (11). A fixed point on the forehead is obtained by projecting the midpoint of a line from nasion to begma, on the surface of the forehead, see Fig. 2.

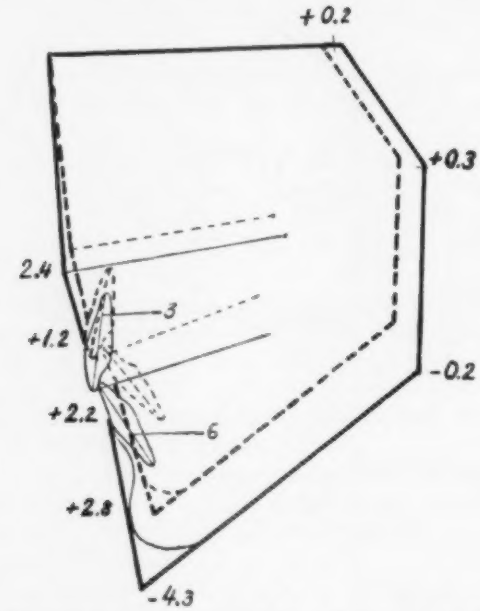

Fig. 3.—Diagram illustrating the cross-sectional difference in facial pattern between 322 Swedish boys, 12 years old, and 281 adult males, 21-22 years old. The differences in prognathism, in the shape of the cranial base, in the inclination of ramus, the jaw and chin angles, and in the inclination of the incisors as measured to their jaw bases, are indicated in degrees.

"In Fig. 3 is shown the cross-sectional difference in facial pattern in Swedes at 12 years and at 21-22, from our study published in 1947. The average change in shape of the cranial base is very slight and the same is also true of the inclination of the ramus and the size of the jaw angle. The profile, on the other hand, exhibits an appreciable change with increased prognathism of both jaws, somewhat greater in the lower jaw than in the upper. The overjet consequently diminishes somewhat on an average. The profile becomes straighter, the chin more pointed and the incisors of both jaws become more upright with age.

"We find, however, that individual cases deviate very considerably in almost every detail from these average growth changes. . . . As I have already mentioned, the average growth changes of the face are characterized by an increase in the prognathism which accompanies the vertical growth of the face. The question is now whether this relationship differs in the individual. . . .

". . . In Fig. 4 the variation in the individual growth changes has been coordinated in a facial diagram, constructed from a preliminary calculation based on 44 cases. The mean change and the range of variability has been noted for the different angles in the diagram.

"In each case the slope of the forehead has increased. The saddle angle shows a tendency to increase. The joint angle is found on an average to re-

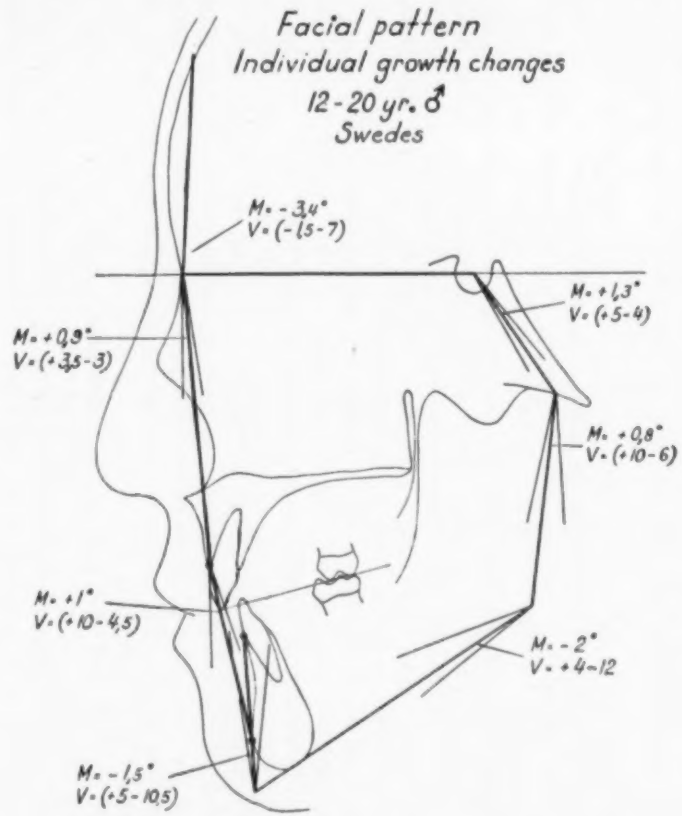

Fig. 4.

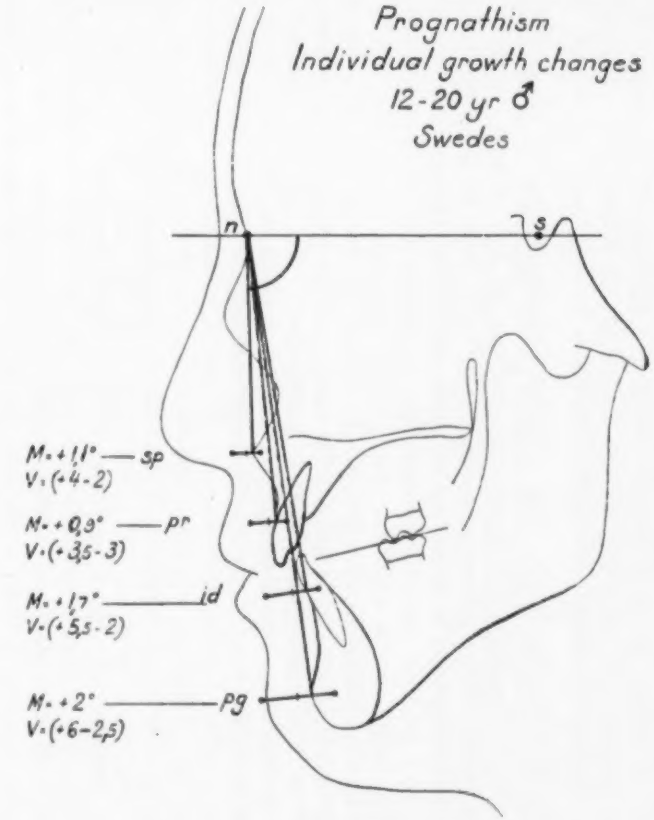

Fig. 5.

Fig. 4.—The individual growth changes in the facial pattern from 12 to 20 years, coordinated in a facial diagram. The mean change and the range within which the individual growth change occurs have been noted for each angle. (A preliminary figure, based on measurements on 44 follow-up cases.)

Fig. 5.—Individual growth change in facial and alveolar prognathism. The mean change and the range within which the individual growth change occurs are denoted in degrees (44 cases).

main constant, whereas the jaw and chin angles show a tendency to diminish. However, the variability of the growth changes of all these angles is considerable, varying positively and negatively around the mean value. The range of variation of the saddle angle is thus 9°, while for the other three angles it is greater, being around 16°, and that of the facial profile angle is of about the same order, as measured from nasion to prosthion to pogonion, i.e. along the facial profile.

"This wide variation in the growth type of facial structure expresses itself as an individually increased or reduced prognathism of one or both jaws. On an average, the prognathism increases somewhat in both jaws, total prognathism. The mean values and ranges of variation of these individual changes are denoted in Fig. 5. It will be seen that the variability is greater in the lower than in the upper jaw.

"The changes in maxillary prognathism during the growth period depend partly on the relative growth in length of the upper jaw in relation to the growth of the frontal part of the cranial base in particular. The growth change in maxillary prognathism is also due to the vertical growth of the upper facial structure causing a forward or backward displacement of the maxilla and alveolar arch in relation to the cranial base. Hence the change in protrusion of the alveolar arches is mainly due to that of the jaw bases. Changes in the mandibular prognathism are apparently dependent upon the other factors which determine the degree of prognathism. Increased mandibular prognathism thus depends on an increased length of the mandible in relation to the length of the cranial base as a whole, an increased deflection of the cranial base or a more forward inclination of ramus (cf. Björk, 1947).

"It is very important from a clinical point of view to be able to judge the growth type of the individual. The first factor to be established is whether the difference in prognathism between the jaws is increasing or decreasing in the case in question.

"The difference in basal prognathism may increase or decrease within a range of not less than 8°. The difference in alveolar prognathism may increase or decrease in the same way, but to a lesser degree; in the cases investigated within a range of 4°.

"It would appear that growth changes occurring in the incisal inclination and in the occlusion are intimately connected with growth changes in the facial shape as a whole. The incisors show an average tendency to an upright position during growth, with wide individual variations occurring in both directions, and in different degree in both jaws. The considerable displacements in prognathism which may occur between the jaws during the growth period can evidently be compensated in some measure by changes in the incisal inclination. The average displacement in the occlusion is also comparatively slight but nevertheless quite distinct, as conclusively estabished by statistical methods from an earlier investigation (1947, 1950, 1951). The overjet therefore diminishes, on an average, but exhibits individual changes in both directions, the variation range amounting to 6.5 mm. in the 44 cases upon which the measurements were based. The same result was obtained for the overbite, which showed a tendency to diminish, with an individual variation of 6.5 mm.

"Apart from the morphological and functional analysis of malocclusion cases, I consider this kind of growth analysis of the greatest clinical importance, especially in cases of pronounced class II or class III occlusions. The primary object of the analysis is to determine the tendency to increased or reduced difference in prognathism between the jaws, covering either a period of observation prior to treatment, or else carried out simultaneously with the treatment."

The fact is that very great changes can take place in the facial structure during growth and that they may have a very marked influence on the occlusion.

News and Notes

American Association of Orthodontists

The next meeting of the American Association of Orthodontists will be held at the Baker Hotel, Dallas, Texas, April 26 to 30, 1953.

The work of the Program Committee is developing nicely. There will be many important essays on timely subjects, presented by capable speakers. A large number of experienced clinicians will present practical technical advances and exhibit results of their clinical practice.

The usual special features of Sunday Buffet Supper, Stag Dinner, and International Luncheon are being prepared. The President's Banquet with entertainment and dancing will climax the social activities.

There will be exhibits by the dental dealers and manufacturers.

The Ladies' Entertainment Committee is preparing a splendid program. Bring the ladies.

The Local Arrangements Committee is making every effort possible to promote adequate and efficient conduct of the meeting and for your convenience.

There will be a comprehensive exhibit of material submitted in 1952 by applicants for certificates of the American Board of Orthodontics.

Make your reservations now at the Baker Hotel.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Baker Hotel, Dallas, Texas, April 22 to April 26, 1953. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Mich. To be considered at the Dallas meeting, all applications must be filed before March 1, 1953.

Great Lakes Society of Orthodontists

The Great Lakes Society of Orthodontists will hold its twenty-third annual meeting at the Royal York Hotel in Toronto, Ontario, Canada, on Nov. 10, 11, and 12, 1952.

Southwestern Society of Orthodontists

The annual meeting of the Southwestern Society of Orthodontists will be held in San Antonio, Texas, from October 26 to October 29, inclusive.

Headquarters for the meeting will be at the Gunter Hotel.

The Society will give a testimonial dinner in honor of Dr. Thomas Gunter Duckworth and Dr. Paul Guy Spencer at the Gunter Hotel, October 27. Both Dr. Duckworth and Dr. Spencer are founders and honorary members of the Society.

Northeastern Society of Orthodontists

The program of the meeting of the Northeastern Society of Orthodontists, to be held at the Mount Royal Hotel, Montreal, Canada, on Monday and Tuesday, Nov. 10 and 11, 1952, follows:

SUNDAY AFTERNOON

2:00 to 5:00 Registration, Sheraton Hall

5:30 to 7:30 Reception and cocktail party, Sheraton Hall

MONDAY MORNING

9:00 Registration, Foyer

9:30 Psychosomatics in Patient Management. John W. January, D.D.S., Santa Monica, Calif. Read by Dr. Raymond Webster.

10:00 Simplifying Our Orthodontic Problems. Clifford L. Whitman, D.D.S., Hackensack, N. J., Instructor in Orthodontics, Columbia University.

This paper is a supplement to former papers because it deals with additional ideas on habit correction and also with the role of musical instruments in orthodontics.

11:00 Case Report. Orthodontic Treatment in an Unsuspected Hypothyroid Adolescent. Richard Pasternack, D.D.S., Mt. Sinai Hospital, New York City.

11:15 Paralleling Roots in Space Closure of Extraction Cases. Brainerd F. Swain, D.D.S., Morristown, N. J.

12:30 Cocktails—Luncheon—Champlain Room

MONDAY AFTERNOON

2:00 The Use of Tissue Bearing Anchorage in Conjunction With Various Techniques in Treatment. Walter R. Bedell, D.D.S., Poughkeepsie, N. Y.

Variations of tissue bearing anchorage will be shown in the treatment of all types of cases.

2:45 The Denture and the Temporomandibular Joint in Function. Robert M. Ricketts, D.D.S., Los Angeles, Calif.

3:30 Executive session. The President requests that members remain.

3:30 Clinics for guests:

1. Plastic Cervical Strap and a Labial Face Bow, Arthur M. Corn, D.D.S.
2. Modified Edgewise Bracket and Arch Wire, Howard D. Dimond, D.D.S.
3. Photography Apparatus, David A. Dragriff, D.D.S.
4. New Type Study Models, Francis J. Laughlin, D.D.S.
5. The Russell Lock, Clifford L. Whitman, D.D.S.
6. Cephalometrics, M. Alden Weingart, D.D.S.

4:00 Clinics for members

Exhibitors, Foyer

TUESDAY MORNING

9:00 Registration, Foyer

9:30 Symposium—Orthodontics and Periodontics.

Prevention of Periodontal Diseases. Cyril D. Marshall-Day, B.D.S., M.S., Ph.D., Dean, Tufts College Dental School.

Histopathologic Analysis of the Periodontium in Function. Irving Glickman, B.S., D.M.D., Professor of Oral Pathology and Periodontics, Tufts College Dental School.

Orthodontics as Related to Periodontics. Herbert I. Margolis, D.M.D., Professor of Graduate Orthodontics, Tufts College Dental School.

A Systematic Approach to Occlusal Equilibration. Edward T. Fischer, D.M.D., Tufts College Dental School.

12:30 Cocktails—Luncheon—Champlain Room

TUESDAY AFTERNOON

2:00 Radiation Hazards in Dental Radiography. E. Dale Trout, B.S., Milwaukee, Wis.
The radiation hazards to both patient and operator in dentistry will be considered. An exhaustive study has been made of the pertinent factors involved. By means of slides and demonstration, these factors will be graphically portrayed and simple basic premises established.

2:45 Growth of the Mandible and Orthodontic Treatment. Robert M. Ricketts, D.D.S., Los Angeles, Calif.

3:30 Executive session. The President requests that members remain.

3:30 Clinics for guests:
1. Clinics to supplement paper of Walter Bedell, D.D.S., by members of New York Johnson Study Group.
2. Clinics to supplement symposium on orthodontics and periodontics.
A. Use of the Articulator, Irving Romanow, D.D.S.
B. Initial Determination of Occlusal Disharmony, Arthur Gold, D.D.S.
C. Technique of Equilibration, Edward T. Fischer, D.D.S.

4:00 Clinics for members
Exhibitors, Foyer

Seminar for the Study and Practice of Dental Medicine

Two hundred dentists, including top dental-medical researchers, will be in attendance at the Ninth Annual Seminar for the Study and Practice of Dental Medicine set for the Desert Inn, Palm Springs, Calif., Oct. 26 through Oct. 30, 1952.

Advance registration, according to an announcement by Dr. Hermann Becks, President and Founder of the Seminar, indicates a capacity turnout for the five-day study session.

University of Pennsylvania

The Thomas W. Evans Museum and Dental Institute of the School of Dentistry, University of Pennsylvania, Philadelphia, Pa., will give a postgraduate course on the philosophy and principles of the Universal appliance. The course will be conducted by Spencer R. Atkinson from April 13 to 18, 1953.

A course on the twin wire mechanism will be given by Joseph E. Johnson, April 6 to 10, 1953, at the University of Pennsylvania.

Notes of Interest

Dr. Richard A. Lowy announces as his associate Dr. Lemuel de Jesus in the exclusive practice of orthodontics at the Carmen Apartments, frente Caribe Hilton Hotel, San Juan, Puerto Rico.

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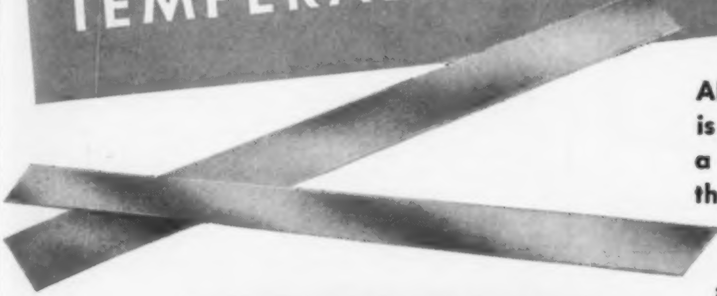

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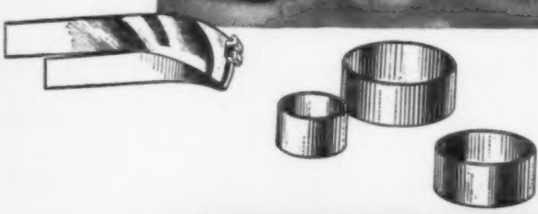

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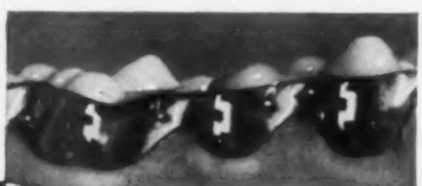

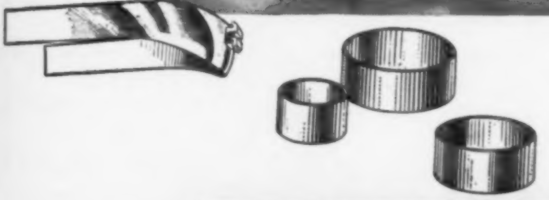

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